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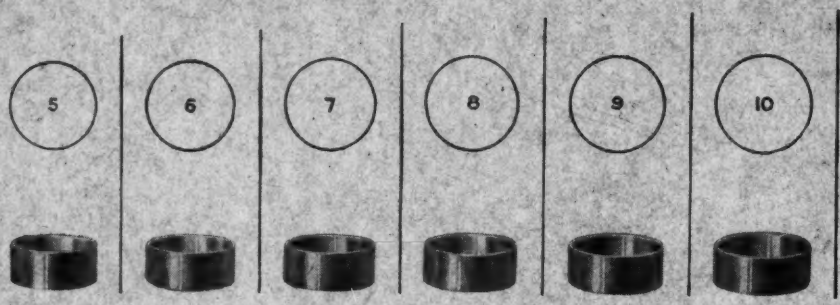

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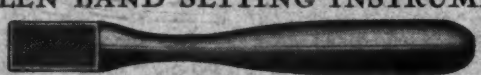

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VOL. XIV ST. LOUIS, JUNE, 1928 No. 6

ORIGINAL ARTICLES

JAWS AND TEETH OF MAN IN THE LIGHT OF THE SCIENCE OF INHERITANCE*

BY DR. A. KADNER, HAMBURG, GERMANY

THERE can be no doubt that dentistry as a science must follow the progress of biologic and medical science. So, for instance, the science of inheritance, the history of evolution, and the theory of internal secretion, are those realms of modern science that can throw an important light upon the etiology of anomalies of the jaws and teeth. These play an important rôle in those theoretical questions that concern our special science.

Referring again to the same subject, I will give you the result of the investigations I have made in the meantime, which I dare say will prove of great value for practical purposes. It will not be necessary, I believe, to speak again of the method I applied. I shall only refer to some results of my investigations of which I have already given you an account in last year's paper.

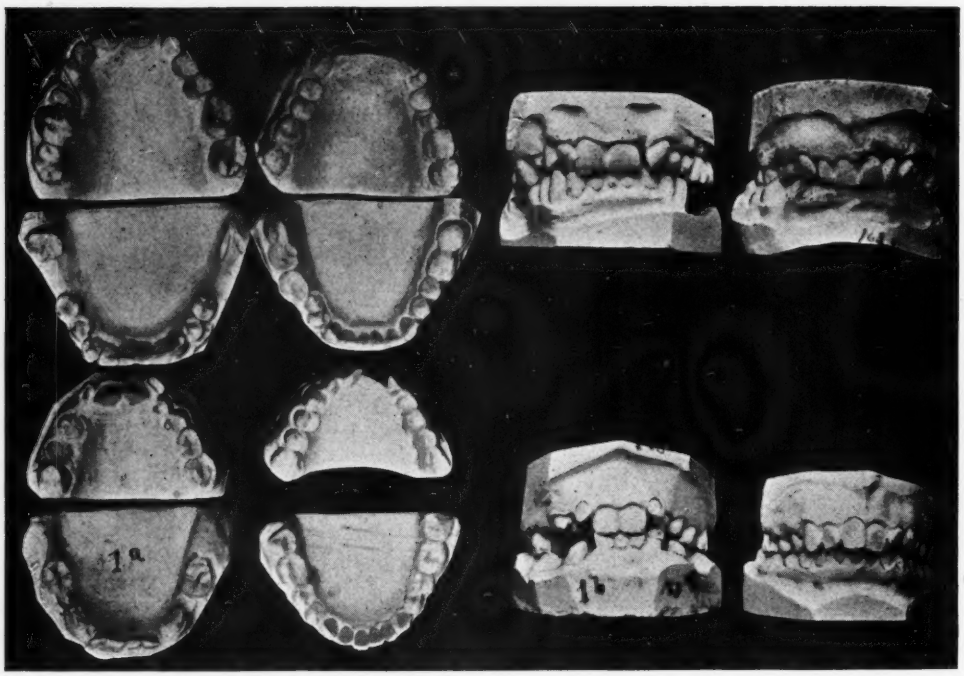
The chief result of my investigations in the theory of inheritance, I explained to you in 1922 in London; I always found in individual children the individual parts of the jaws of the parents. I could state that, in consequence of the mixture of normal parts of the parents, anomalies of the position of the teeth could be brought about with the children. I called them "disharmonies," because they could not be considered as genuine anomalies as caused by disease or abnormal dispositions. They are most certainly caused by an intermixture of normal parental parts. One example you can see in this picture. (Figs. 1-*A*, 1-*B*.)

There exist, of course, also genuine anomalies, inherited in families through generations, as shown in Figs. 2-*A*, 2-*B*, and 3. Last year, in Amsterdam, I explained that these genuine anomalies are most probably due to dis-

*Read before the Annual Meeting of the European Orthodontological Society.

turbances of the balance of internal secretion. However this may be, one finds with these children, at the age of puberty, a dysfunction of the blood glands in addition to an impaired function of the hypophysis and the thyroid gland. You see here examples of cases in families of such anomalies occurring suddenly. They are the same forms as I found inherited through generations. (Figs. 4 and 5.)

I tried to find further analogies in medical science which might throw some light upon the possibility of such an inheritance of pathologic deformities of the jaws and teeth. Of course, I shall select such analogies only which have some connection with deformities of the chewing apparatus. Such comparisons are of no little value because, in this way, it is possible to get in touch with the real foundations of the development of anomalies in general.



A. *B.*

Fig. 1-*A*.—The anomalies of both children are caused by the mixovariation of the parental parts. (Lateral part of the maxilla and mandible is the same with the mother, intermaxillary with the father. The father shows a small intermaxillary bone without lateral incisors.)

Fig. 1-*B*.—With the son the lateral incisors of the maxilla are passed to the outside; with the daughter the four incisors are shifted together.

Sometimes anomalies of the jaw have been described in connection with anomalies of the hair and nails. The latter anomalies are considered by scientists as caused by dysfunctions of the endocrine glands. Other scientists presume that psychic defects connected with the anomalies of the jaws might also be based upon disturbances of internal secretion. And I may say that my own ideas and special experiences are in full accordance with these opinions.

Disturbances of internal secretion can, at certain times, during the development of the child, undoubtedly be detected, and in later age, deformities of the jaw caused thereby can be found, as shown in Figs. 6-*A*, 6-*B*, and 7.

Obviously, this secret remains to be explained. How does it come about that these anomalies, caused by the disturbances of internal secretion, get inherited in families through generations? My idea about this question is the following: The blood glands rule the growth of the body; they are connected with each other by unknown ties, most probably the solar plexus. If, for instance, there occur damages of the sexual glands, which are responsible for the preparation of the new germs, this will influence the substance of the germ, which contains the idioplasm, and an idioplasm influenced in this way is able to produce the same anomaly throughout many generations.

The question now is, whether my findings are in accordance with the Mendelian laws; undoubtedly these laws as applied to man, may, and must

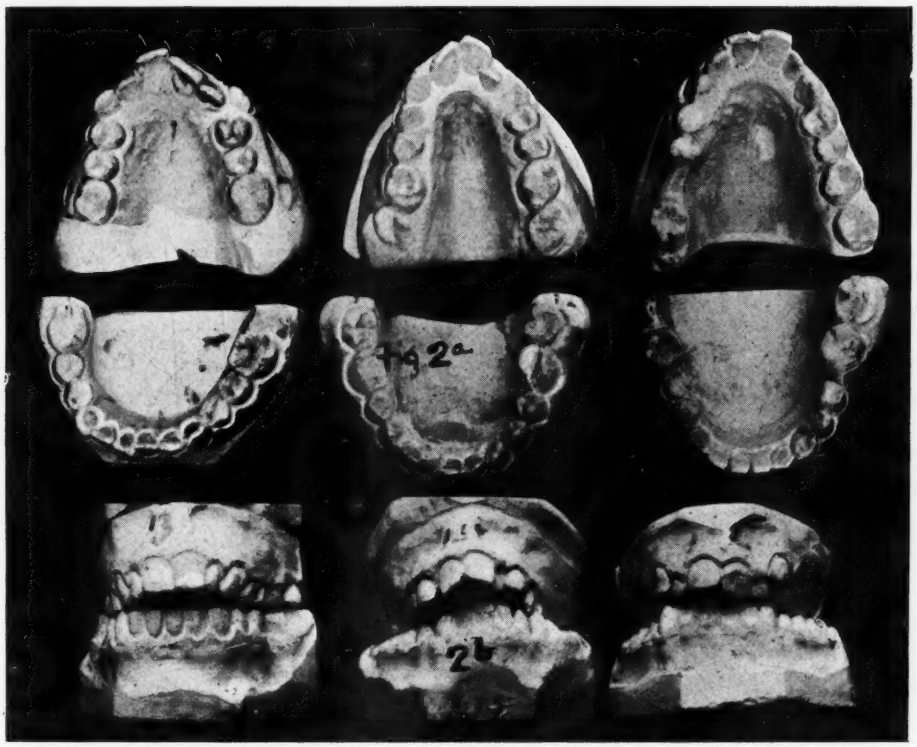


Fig. 2.—High palate with arrested growth of the maxilla inherited through generations.

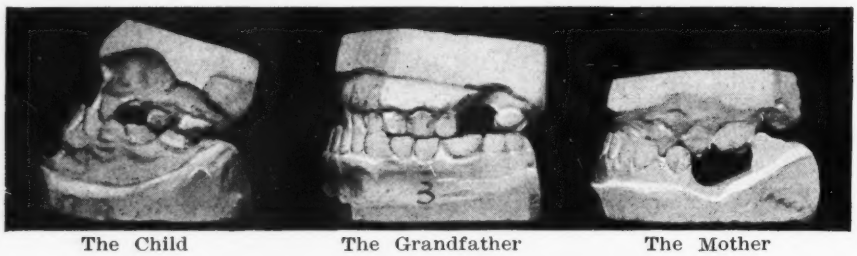
be, applied to the science of inheritance. For this purpose, those cases which I have described as being disharmonies of jaws, brought about by mixovariation of normal parental parts, must be statistically valued.

Whereas such factors that underlie inheritance are conditioned by one couple of hereditary germ-layers, there must exist in the idioplasm two couples of hereditary germ-layers, the one of paternal, the other of maternal origin. And as half of the idioplasm gets lost during the germ-ripening, there always remains only one couple of hereditary germ-layers, each component of the couple always being transmitted either by the one or by the other parent. This is the chief point of Mendel's laws. I found, for instance, the lateral parts of the maxilla always agree with one parental part. This would

prove a case of Mendelian dominance, the one parental part dominating over the other parent.

Now with regard to the explanations of the appearances of the masticatory apparatus of man, a statement will be necessary of the predominant forms of jaw, which anthropologically are called "prognathism" and "orthognathism."

I only apply these terms characterizing the external appearance which have been used in dentistry for many years, although these expressions are



The Child The Grandfather The Mother

Fig. 3.—Anomaly inherited through three generations.

Fig. 4.—Primary disturbance of growth in connection with a psychical defect.

Fig. 5.—Seven children of a family showing the same anomaly connected with inherited epilepsy (*vide* the scheme of inheritance).

not scientifically exact. In my essay on the problem of inheritance of jaw and teeth deformities, I was able to trace in many single families that the forms of the jaws are apparent, showing undoubtedly that the more protruding jaw is always predominant. It is most interesting to refer, in this respect, to the experience of some prominent scientists.

For instance, Magitot (1858) made a research of the origin of anomalies, and explained them from the standpoint of the science of inheritance. Roberts again considered the chief cause, the intermixture of races, as explained

by him at the sixth anniversary of the American Dental Convention. He found that the jaws of the Germans were broader and those of the Irish narrower than those of the Americans, and that when an intermixture occurs of the more narrow Irish jaw with broad German teeth, anomalies must be the

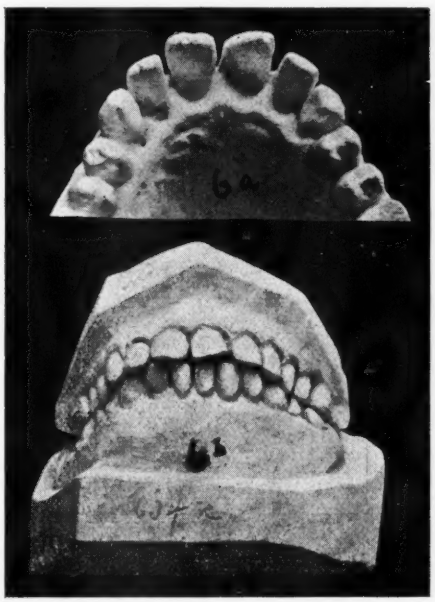


Fig. 6.—*A*, Abnormal protrusion of the frontal teeth caused by the disturbance of the glands of interior secretion (after ovariectomy). *B*, Model shows that the anomaly is *not* caused by the function of the bite.

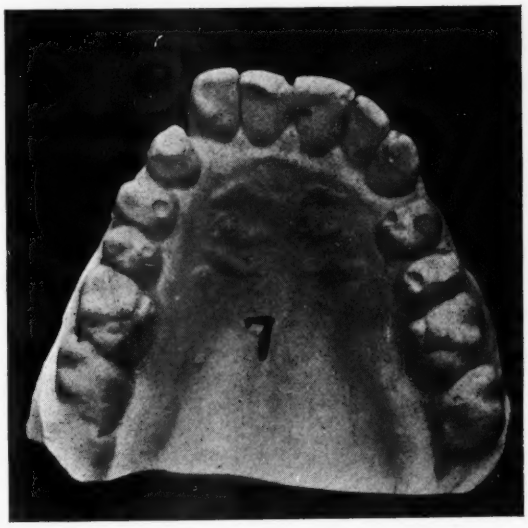


Fig. 7.—Protruding growth in the beginning of menopause combined with a dysfunction of the glands.

result. Colbrum could find no irregularities with the natives of the Sandwich Islands, or of California and Central Africa, which fact he considered as a sign of the purity of these races. Already, in 1880, Kingsley had made very extensive investigations of the etiology of anomalies, and was fully convinced

it was due to inheritance. Kingsley believed that compressed jaws are an acquisition of modern times. Also he rejects the opinion that mouth-breathing produced anomalies of occlusion and believed that future generations will progressively show increasing irregularities.

Talbot, about 1890, mentioned that irregularities of the jaws and teeth have never been found in the ancient races, neither can such be noticed with unmixed races of our time.

If one considers the experiences of these scientists, which undoubtedly were based upon enormous material, as convincing, this would be in full accordance with what I have found myself. The statements of the above-mentioned scientists, that anomalies of occlusion are very rarely to be found with pure modern races or with the ancient races, but that they are on the

A.

Fig. 8.—Protruding growth is distinctly to be seen. *A*, After four months.

increase in the jaws stunted in growth by the intermixture of civilized races, can be very easily explained by the fact that even at present the original form is still predominating. That is to say the more protruding form will dominate over the more reduced form in the future type of man.

Now my second chief question is this: Is it possible that the single parts of the jaw may be considered as parts, which can be separately inherited? Here I must duly refer to some most important researches by Professor Fischer, of Friedburg, on the problem of bastardizing. As an instance of his results I mention the following: Fischer says that the bridge of the nose, its sides, its root, and its tip can be inherited separately. Therefore for the nose there exist four factors of inheritance.

And how is it with the human jaw? I can state, as I explained to you in 1922, in London, that there exist for the tooth-bearing part of the jaw, four independent components of inheritance. And if we include the palate bone, which I was unable to measure, as another factor of inheritance, we would

Jaw deformity and harelip. Jaw deformity.

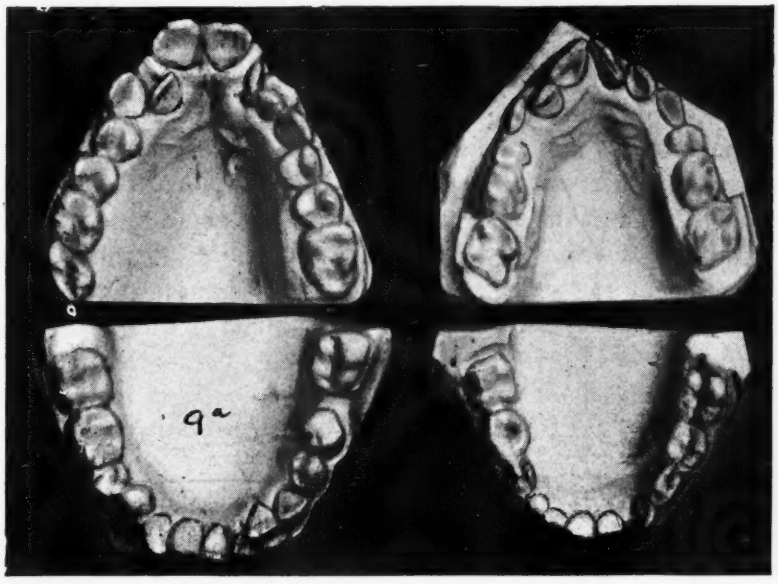


Fig. 9-*A*.—Disturbance of the germ in a family, consisting in anomaly of the jaw, harelip and cleft palate (*vide* the scheme of inheritance).

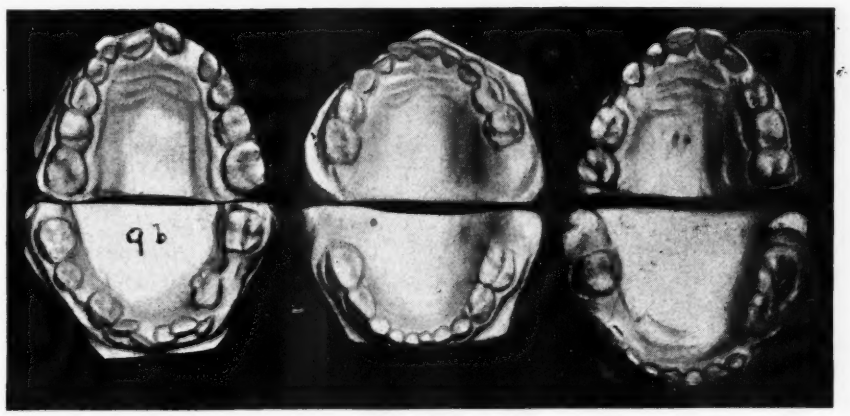
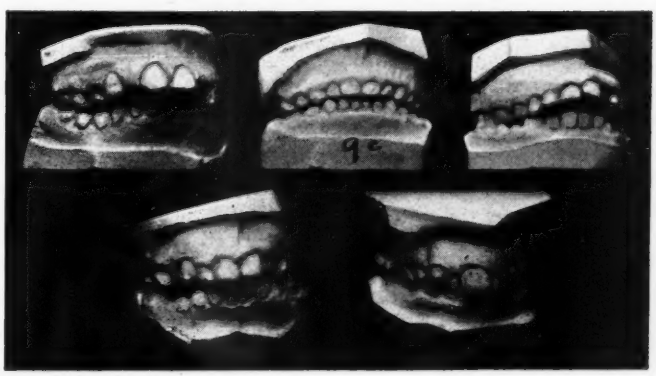
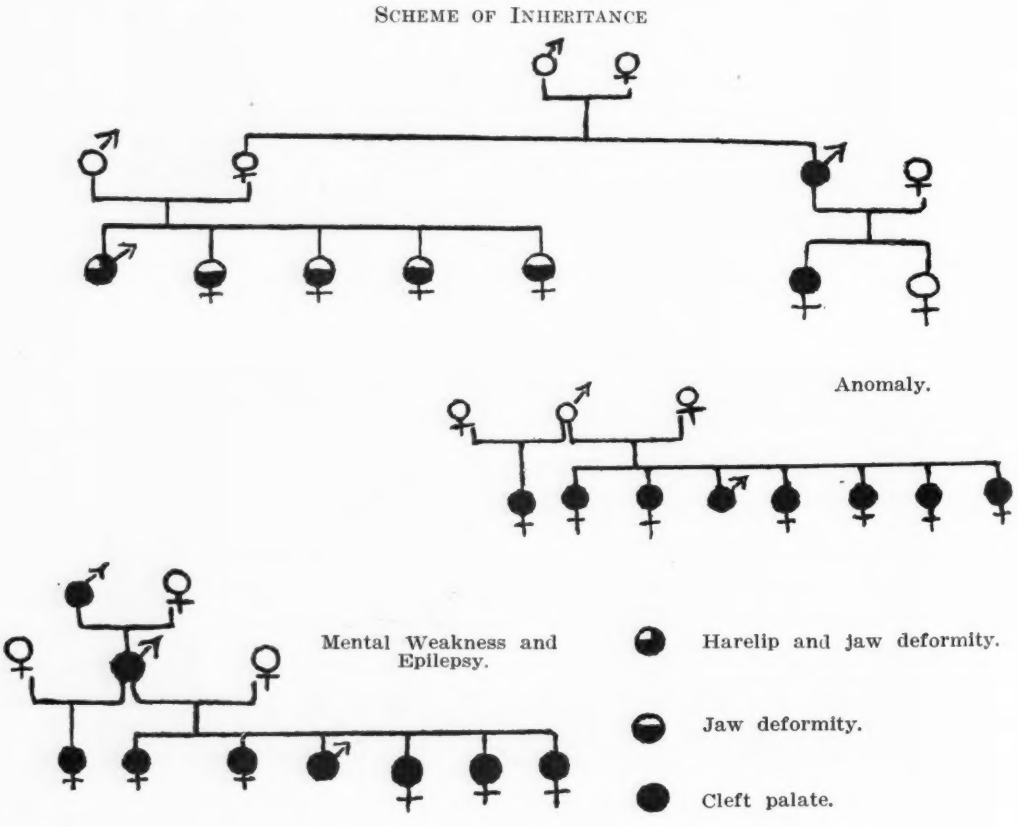


Fig. 9-*B*.—Jaw deformity. Jaw deformity (only slight). Jaw deformity.



have at least five independent factors for the jaw, namely, the intermaxillary bones, the lateral parts of the maxilla, the mandible, the teeth and the palate bones.

Let us now consider the inheritance of genuine anomalies of the position of the teeth; we find the explanation for this in pathologic inheritance. No doubt disharmonies are not disease, but it is quite certain that the deformities of the jaws and teeth are due to disease. In such cases it is very surprising that one always finds in the family in question the same kind of formation of the jaws; therefore the anomaly present will strike you as the most prominent feature. Looking at the scheme of inheritance of single families, it must be



stated that anomalies in the single families will mostly occur as dominating. The fact is that families will go to the doctor for their complaints, when the effect of the abnormal disposition has reached its climax, and then, of course, can more easily be investigated. It is a great pity that in the majority of cases it is quite impossible to extend the investigation for generations. To study the uniformity of the scheme of inheritance in a few generations of as many families as possible is quite sufficient for stating the cause of inheritance. Thus, for instance, a great number of anomalies were due to impediment of growth, and these disturbances were so marked that crippling of the jaws in various degrees was the result. There were also noticed different degrees of cleft palates in families, and in such families single cases will usually be found which only show a slight trace of such deformity, which, of course,

must carefully be recorded as pointing out disturbances of the germ. (Figs. 9-*A*, 9-*B*, and 9-*C*.)

So much about the question of hereditary disharmonies and anomalies. Beside these, undoubtedly there exist acquired anomalies of occlusion, as for example, thumb-sucking or otherwise. But these can never be inherited. Regarding the mechanical influence on the formation of the jaws, one can say that they are by no means as important as some scientists seem to believe.

For instance: A narrow jaw will as a rule not be caused by some mechanical lateral pressure, but as I have proved, is due to defective lateral growth. I think it is about time to stop talking about the deforming influence of mouth-breathing and such things, a theory which was rejected fifty years ago by Kingsley.

The practical value of my researches, which I have only outlined above, I hope to give you later on in a separate paper.

DISCUSSION

Mr. G. Korkhaus said the paper was a very interesting one and he could not quite agree with Dr. Kadner as he had neglected some points which were of great importance. At first it might be said that in cases with similar jaws he had proved inheritance through two generations. It was very probable that the forms of the whole of the jaws were really inherited like the forms of the nose, but not any particular part of the jaws. Disharmony of the jaws must be followed by disharmony of the teeth. There was no doubt that jaws and teeth belonged together, and besides inheritance there was development. According to Dr. Kadner, in all cases of mixed variation he had shown, disharmony of the teeth was found. There were other reasons for rejecting the very interesting but unfounded theory of Dr. Kadner, but those reasons went far back into the difficult region of the science of inheritance. He thought deformities of the premaxilla due to weakness of bones on account of disturbances, without the presence of rickets, had not been proved up to the present.

Dr. Levy Davidsohn was quite convinced of the importance of the paper from a scientific point of view, but she could not find out what value it was in practice. There were many cases of animals where the causes had ceased to exist or where it was impossible to trace them. When the parents were alive probably it would have been impossible to get impressions of them. What was to be done, then? Should orthodontists refuse to treat the abnormalities at all? Was there a difference in the treatment of inherited and acquired abnormalities? When children had inherited abnormalities from their parents, why should not those abnormalities be observed as abnormalities? She was not an investigator in those things, but it seemed to her that it contradicted all she had read in textbooks on anthropology. Children were not only the product of the combined normal qualities of parents, but by inheritance they very often had real abnormalities produced, and that would be found to be so in all organs of the body. Why were teeth the only ones excluded? Heredity was a very important factor and an aid to diagnosis, but it was impossible to base diagnosis and therapy on heredity as a basis.

Dr. Kadner, in reply, said that if the same forms were seen through generations they could not be formed altogether by exterior influences. With regard to the theory of intermixture in cases, he had only shown one example. With regard to Dr. Levy Davidsohn's remarks in reference to the theory of inheritance, he had sent his information to four scientists, the greatest scientists in Germany, Professor Fischer, in Freidburg, a man with an international reputation, and Professor Linz, in Munich, and others, and all agreed with him and said it was most important for the theory of inheritance. It could not be known whether it was important for other people, but it was important for orthodontists.

SOME REMARKS ON DENTISTRY TODAY*

By J. Lister Scott, L.D.S., London, England

SOME of you may remember the story of the old actor who had seen better days. He had taken his place one Sunday morning in the queue at the booking office of a London railway terminus, no doubt with the object of booking for the town of his prospective week's engagement. When it came to his turn he said to the booking clerk, "I want to go to Wigan." A little comedian who was next in the queue, viewing the shabby appearance of the old actor said, "You're a liar: you've *got* to go to Wigan." And so tonight I feel like an old actor who has played his part, and the time has come when I've got to go.

It seems as if the curtain has already been rung down on my year of office, and I am simply called before this representative audience to deliver a few farewell words of thanks, and to make as graceful an exit as possible. And perhaps I shall be expected to say no more than to thank you all very much for making my year of office so interesting, so instructive and so easy.

It is no small honor to be president of one of the most scientific societies in the North of England, and I have nothing but the most pleasant memories of a very happy year of office. Our Odontological Society is the dental surgeon's own society. It is a postgraduate course for the young practitioner, and, if for no other reasons than these, the society should flourish.

I think much more is needed and expected from a society such as ours and its individual members when we read a physician's statement that dental surgery has been, and still is, too much occupied in "doing things," and, in consequence, has too little time at its disposal for that of creative imagination. Such a statement ought to make us sit up and take just a little notice. The dental profession is credited with being too well off.

As soon as qualified, we are told, most men plunge right into general practice, more or less lucrative, and there is such a demand for their services that their time is fully occupied in "doing things," and at a scale of remuneration sufficiently adequate to make their conditions in life comfortable and prosperous. And so we are accused of being content to carry on with the remedial side of our art at the expense of research.

I think that as a profession, we can certainly claim to be inventive, because we are occupied in doing things. That being so we can hardly be accused of lacking the virtue of creative imagination. As a comparatively young profession, I am inclined to suggest that we have advanced almost to stages of perfection in some branches of our art. But as a body of professional scientific men, I think we may confess that we are not too energetic in scientific research.

*Read before the Annual Meeting of the European Orthodontological Society.

At the same time, I suggest that by the experience we have gained and are gaining as a profession, and by our most recent discoveries and modern methods of treatment and application, we are gradually beginning to understand the cause and wherefore of certain conditions. We are told by Professor Maxwell Telling that we cannot satisfactorily answer such a question as, "What is civilization doing to ruin our teeth?" Well, perhaps we think we know the answer to that question, and no doubt we confide in our patients and tell them exactly why their teeth decay, and how they can prevent them decaying. But these same patients still return to us for further necessary treatment, and so do their children.

Then again, we are told we have an absolute rule for the treatment of pyorrhea. Professor Telling reminds us that we have one school of practitioners dallying with vaccines so long as the patient's finances will stand it, another will carry out local surgical treatment just short of radical extraction, while there is yet another school which demands radical treatment of the teeth affected, which from the physician's point of view seems to be the most favored.

Then again, why cannot we be more or less agreed on the question of the so-called dead tooth? We are advised by well-known observers and otherwise brilliant men in our profession to extract all dead teeth at sight, and yet we know from experience that such teeth can, with care, be made useful and inoffensive organs for mastication and appearance for many years.

I suggest that common sense, coupled with our present knowledge and accepted theories, should be our guide in deciding our line of action in most cases. But it will be by the interest you take in the Odontological Society, and the large number of attendances you are able to record that may eventually help to solve some of these important questions.

Dental research is more or less thankless work, and there are no very large bouquets waiting for those who may be attracted to this interesting subject, even if successful.

On the other hand, medical research never seems to lack enthusiasts. There seems to be so very much more yet to discover for the benefit of mankind and the direct saving of valuable lives. Whilst the greatest honors await the men who may be successful in this direction, dental research is more limited, and honors probably less attractive. But, with the splendid example and sacrifices already made by many members of our profession, and with the wonderful discoveries they have already made, we may hope that dental research may not be neglected in the future, and, no doubt, our Dental Board will help to make the study of this subject worth while.

I wish to take this opportunity of thanking all the members who have so generously supported me and our society during my year of office by their regular and appreciative attendances, and also to members and friends, both medical and dental, who so generously came forward with papers and demonstrations of great interest, and to all those members who took part in the discussions, and whose criticism added so greatly to our knowledge of the various subjects brought before us.

And to my indefatigable secretaries I convey my warmest thanks and appreciation of their labors and the valuable work they have undertaken and accomplished on behalf of our society.

The stage is now set for the entrance of your new president, and the spotlight of glamor and glory is about to be focused on his genial countenance, and it would not be right of me to keep the curtain waiting. But, before I close, I wish to congratulate you on the selection of your president for the ensuing year. Any regrets I may have in leaving this chair will be amply compensated for by the pleasure it gives me to instal Mr. Currie in his high office. In Mr. Currie you will have a president who will be popular, a gentleman who has ability and who is in every way capable of conducting and presiding over meetings in a dignified and professional manner. I sincerely trust you will show your appreciation of your new president by establishing a hundred per cent record of attendances during his year of office.

Lastly, I wish our Odontological Society every possible success in the future, and may it flourish for the benefit of its members and the whole community. I now have the greatest pleasure in asking Mr. Currie to take the chair of the North of England Odontological Society for the coming session, and I wish you, Mr. Currie, a most happy and prosperous year of office.

First District Dental Society, State of New York

The First District Dental Society of the State of New York will hold its fourth annual December Meeting for Better Dentistry at the Hotel Pennsylvania, New York City, on December 3, 4, 5, 6, 1928.

The Committee is arranging a meeting of the same standard as those of former years.

Essayists and clinicians eminent in their fields are being invited and an announcement of their personnel will be made at an early date.

This year the meeting will continue for four days and the same plan of subscription will be continued.

There will be a manufacturers' exhibit in the hotel during the continuance of this meeting.

John T. Hanks, Chairman.
Armin Wald, President.

ORTHODONTIC BANDS*

By O. Rupprecht, M.D., Professor, University of Ghent

THE question of orthodontic bands is of capital importance for every specialist applying himself to orthodontia. Indeed, the adjustment and placing of bands, together with the taking of impressions, constitute nearly all the technics of the orthodontist's office. It follows that great interest attaches to a severe criticism of the process of making orthodontic bands. Ascertaining errors of observation or of interpretation in the theory, of faults or imperfections in the technics of this fundamental operation, may lead to improvements of great practical importance.

Firstly, I shall treat the bands on the first molars and examine afterwards, under a special number, the bands on anterior teeth. Anchor bands may be of two different types: the clamp anchor band and the fitted anchor band. Of the two, the fitted type is used today by most specialists in orthodontia. The aim of this paper is not to give a complete report on the question of orthodontic bands, but principally to call attention to the result of personal thought or considerations closely allied to it and to personal technics. Things which are currently found in textbooks or in articles of reviews will be passed over or shortly treated here.

I. THE FIXITY OF PLAIN BANDS ATTACHED TO MOLARS

If, after a long competition with the clamp anchor bands, the plain bands are at present most generally used, this does not mean that plain bands are free from reproach. In 1900, in the sixth edition of his book, Angle says that the shapes of molars and premolars and their positions in the mouth make it substantially impossible to fit plain bands to them so that they will not soon loosen under the necessary strain of tooth movement. In 1920 he admits that plain bands may in skillful hands afford reasonably firm media of attachment between the teeth and the power part of the mechanism, but, according to him, they frequently give trouble by loosening under the constant jarring incident to occlusion and by reason of the strain of the appliance.

Dewey writes that it requires long experience before one is able to make a plain band on the molars and premolars that will in any manner nearly approach the neatness of the anterior bands.†

The question of fixity of plain bands upon molars has been in recent years often treated in articles of reviews and in discussions of societies.

In April, 1922, T. G. Duckworth read before the Alumni Society of the Dewey School of Orthodontia a paper upon the importance of a good technic. According to him, it apparently seems that the mandibular molar bands are

*Read at the European Orthodontological Society's Congress.

†Martin Dewey, "Practical Orthodontia," first edition, p. 153. London: H. Kimpton, 1915.

the most difficult to accurately adjust as they more frequently come loose. This implies that the loosening of other molar bands is by no means a rarity. In the discussion of the paper, Harry L. Hosmer said, without being contradicted, that molar bands come off with disgusting regularity.*

In a paper read before the European Orthodontological Society, July, 1922, C. A. Hawley said that cemented bands are liable to become loosened.†

In a communication to the Pacific Coast Society of Orthodontists, February, 1924, Harvey A. Stryker examined the elements intervening in the success of making molar bands.‡ The reading of this paper was followed by a long discussion, at the end of which Stryker advised, without meeting any contradiction, to remove these bands at least every six months and to recement them. This proposition of spending every year a considerable amount of time to do a work again shows that the author considered the coming off of molar bands as an always threatening eventuality.

In an article published January, 1926, A. Edel writes that several times coming off of anchor bands during a regulation is not fancy, but reality.§

My experience of many years leads me to the same opinion as that expressed by the above-mentioned specialists. Many and many hours of preceding years were lost with work necessitated by the loosening of molar bands. At any moment of the day one was liable to be obliged to urgently repair an apparatus from which a band came off. The following part of this paper describes results which I am actually able to obtain.

II. METALS EMPLOYED

Fifteen to twenty years ago German silver was nearly universally used for the making of orthodontic bands. Since that time the advantages of alloys of precious metals have been more and more appreciated, and at present their use has in a very large measure superseded that of German silver. A good number of such alloys have been put upon the market, especially by American manufacturers, and the greatest number of these alloys can be used with satisfactory results. Unfortunately their price is too high for our countries with depreciated exchange. For the last seven years I have used an alloy the formula of which I received from my excellent colleague, B. R. Bakker, professor at the Dental Institute of the University of Utrecht. This formula, which is the result of purely theoretic considerations, is the following:

Gold	75	grammes
Silver	8	"
Platinum	2	"
Copper	15	"

*T. G. Duckworth, "The Importance of a Good Technic," INTERNATIONAL JOURNAL OF ORTHODONTIA, 1923, pp. 331-339.

†C. A. Hawley, "The Principles and Art of Retention," *Transactions of the European Orthodontological Society*, Sessions 1922 and 1923. London: The Dental Manufacturing Company, Ltd.

‡Harvey A. Stryker, "A Practical Talk on Molar Band Technic," INTERNATIONAL JOURNAL OF ORTHODONTIA, 1924, pp. 621-640.

§A. Edel, "Een gewijzigd model regulate schroefband en bandmaterial," *Tijdschrift voor Tandheelkunde*, January, 1926, p. 41. Utrecht: G. J. & D. Tholen.

This alloy, the price of which is about that of pure gold, gives me complete satisfaction. It has sufficient adaptability, is extremely resistant and is not deformed in the mouth, when the band is only exposed to strains which it must inevitably support. In order to render it more adaptable it must be warmed until it gets red, preferably on an annealer, and at that moment plunged into water.

Before studying the making of molar bands, one must examine carefully the anatomy of these teeth. The whole problem of making these bands is dominated by the anatomy of the teeth upon which they have to be adapted. This is an elementary truth which has too often been lost to view.

III. ANATOMY OF THE FIRST LOWER MOLARS

Four surfaces of the crown are of special interest: the buccal, the lingual, the mesial and the distal surfaces. The buccal surface of the mandibular first molar is irregularly trapezoidal in form, with (after G. V. Black) the occlusal margin about two-sevenths longer than the gingival (Fig. 1). It is convex in all directions, the highest part of the convexity being near the gingival

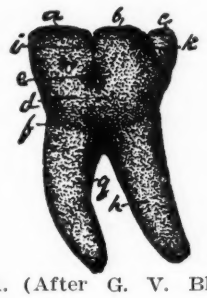


Fig. 1. (After G. V. Black.)

Fig. 2. (After G. V. Black.)

line. There the enamel terminates in a marked inclination toward the gingival line, forming the buccogingival ridge. The convexity appears very distinctly in the mesiodistal direction, but, in the vertical sense, the buccal surface gives very frequently, in the greatest part of its height, rather the impression of an inclined plane, directed downwards and outwards (Figs. 2 and 3). This impression is especially manifest when examining teeth of young people, where the gums cover a good part of the crown. The buccal surface has two, generally very marked, grooves, the buccal groove and the distobuccal groove.

The lingual surface is also convex, but the highest part of the convexity is occlusogingivally situated in the middle of this surface, or nearer from the occlusal than from the gingival margin. This disposition, reverse or nearly reverse from that existing on the buccal surface, is unfavorable for the making of bands. The difficulty is often increased by the fact that the occlusal margin of the lingual surface is situated much higher than that of the buccal surface. Near the gingival margin the lingual surface is flat or often concave occlusogingivally. If, on the middle of this part, a perpendicular line is erected upon the great axis of the tooth, it passes very often close to the greatest height of the convexity of the buccal surface. The

lingual surface is much narrower gingivally than occlusally. It presents the more or less marked lingual groove.

The mesial surface is much broader gingivally than occlusally. This character, reverse of that observed on the buccal and lingual surfaces, constitutes a favorable element and counterbalances, at least partially, the unfavorable disposition of these surfaces. The mesial surface is slightly convex or flat in its occlusal part. In its gingival part it is flat or slightly concave from buccal to lingual.

The distal surface is smoothly convex from buccal to lingual. From the occlusal surface to the gingival line it is straight or slightly convex, but forms a considerable concavity at the junction of the crown with the root.

Black has measured the diameters of a great number of teeth. He has published a table of his results, given in inches and hundredths of an inch, and another in millimeters and tenths of millimeters. The results of his

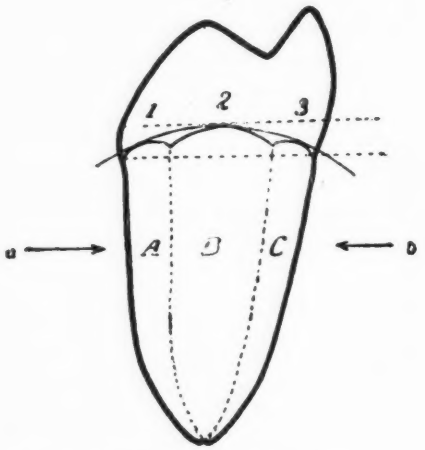


Fig. 3. (After de Jonge Cohen.)

measurements of first lower molars, given in fractions of an inch, are the following:

Average mesiodistal diameter of crown	0.33 in.
Average mesiodistal diameter of neck	0.33 "
Average buccolingual diameter	0.40 "
Greatest mesiodistal diameter of crown	0.37 "
Greatest mesiodistal diameter of neck	0.37 "
Greatest buccolingual diameter	0.45 "
Least mesiodistal diameter of crown	0.23 "
Least mesiodistal diameter of neck	0.29 "
Least buccolingual diameter	0.39 "

The mesiodistal diameter of the crown is the extent from mesial to distal at the points of proximate contact and that of the neck was taken at the gingival line. The buccolingual diameter was generally taken midlength of the crown, and occasionally it was near the gingival line.

One would be inclined to conclude from these numbers that the mesio-

distal diameter of the first lower molars is, at the height of the neck, equal to, or even larger than its extent at the points of proximate contact, and that the greatest buccolingual diameter is much larger than that taken between the two contact points. There is something disconcerting, which makes necessary a careful critical examination of the numbers here mentioned.

The measurement of the greatest buccolingual diameter has evidently no great value as, in certain cases, it concerns the diameter taken mid-length of the crown and, in other cases, the diameter taken near the gingival line. The other numbers give the result of measurements taken at random and cannot be compared with one another. They can, though being exact, give a mistaken idea of the real relations in a given case.

Harvey A. Stryker* concludes from these measurements and from others taken upon maxillary molars, that if a previously adjusted band is passed over the tooth, the band spreads mesiodistally in going over the contact portion, but as it is pressed down over the tooth it spreads buccolingually and draws in mesiodistally and is thus accommodated to the tooth form at the gingival margin.

This is a purely theoretic appreciation, which would be contradicted by a simple experience upon an extracted molar. Furthermore, the numbers of Black, which I have already mentioned, differ considerably from other numbers of the same author representing in millimeters and fractions of a millimeter, the results of measurements made in the same conditions. Here are those results:

Average mesiodistal diameter of crown	11.2	mm.
Average mesiodistal diameter of neck	8.5	"
Average buccolingual diameter	10.3	"
Greatest mesiodistal diameter of crown	12.0	"
Greatest mesiodistal diameter of neck	9.5	"
Greatest buccolingual diameter	11.5	"
Least mesiodistal diameter of crown	11.0	"
Least mesiodistal diameter of neck	7.5	"
Least buccolingual diameter	10.0	"

These numbers, completely at variance with those given in fractions of an inch, show the danger of grounding upon statistics which give the average result of more or less numerous measurements made upon objects taken at random.

If one wishes to know the difference of circumference of a molar near the occlusal surface, at the height of the contact points and farther, from occlusal to gingival, it is best to take extracted teeth and a metal wire mounted upon a dentimeter. Fig. 4 gives the result of such measurements made upon three mandibular first molars. The first line gives the length of the circumference near the occlusal surface, the second line gives this length taken at the height of the contact points, the third line gives the length of the circumference at

*Harvey A. Stryker, "A Practical Talk on Molar Band Technic," INTERNATIONAL JOURNAL OF ORTHODONTIA, 1924, p. 635.

about 4.5 mm. from the occlusal surface and the fourth line the length of the circumference at the neck. Such a figure gives a just idea of the degree of perfection attainable by orthodontic bands.

It would be possible to adapt with complete exactness, upon a body of the shape of the crown of a mandibular first molar, a knitted or rubber tubing. It is quite impossible to adapt upon it a perfectly fitting metal band. As such perfection cannot be obtained, we must do our best to fit the band as nearly to the tooth as possible.

IV. THE MAKING OF BANDS FOR THE FIRST LOWER MOLARS

It is of great importance that the band material is of well-determined thickness and width. The thickness varies somewhat with the resistance of the material employed. The platinum gold which I use for molar bands has a thickness of 0.16 mm.

The width of the band has a much greater importance than is generally conceded. The band must be wide enough to take a good hold of the tooth.

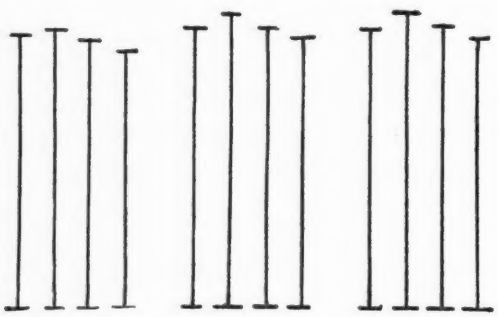


Fig. 4.

Therefore it must of course take the entire broadest part of its circumference. From there it must extend occlusally to near the occlusal surface. As to the gingival limit, one reads in the textbooks that on the buccal and lingual surfaces the band must descend very slightly under the gums and that it must be festooned on the mesial and distal surfaces in order to avoid lesions of the soft tissues.

I do not know any fixed guide to take here as to the height of the gingiva, as this is very variable and changes even during the course of the treatment and has no relationship with the anatomic shape of the tooth. This latter must principally determine the form of the band. I pointed out (Fig. 4) that from its broadest part the circumference of the crown of the first mandibular molars diminishes gradually down to the neck and that, at this level, its length is smaller than close to the occlusal surface—the more one approaches the gingival line the more it gets difficult to obtain even an approximative adaptation of the band.

In order to remedy this inconvenience, I do not trouble to have the metal come under the gums on the buccal and lingual surfaces, and I give it a width of 4¼ mm. In the great majority of orthodontic treatments a band of that width descends everywhere more or less under the gingiva. If, however, in

some place a part of the tooth is not covered by the band, I do not consider this as having the least importance. I suppose now that the measurement of the tooth has been taken and the band soldered. Most authors appreciate that the gingival part of the bands must be festooned mesially and distally, in order to avoid lesions of the gums and of the periodontium. Practitioners who are of this opinion must now trim the bands, leaving sufficient width to maintain their strength. As a rule I do not festoon the bands. In order to stay well in position, it is essential that they get the tooth at the height of the contact points, as well as encircling the tooth above and below these points. The width which I give them, in order to improve their adaptation gingivally, is such that any diminishing would weaken them seriously. Nothing is stronger than its weakest point.

I treated a young man with whom the anatomic and physiologic conditions of the teeth and the mouth were of such nature that the molar bands came off when they were festooned in an annoying manner, after a few weeks. I then decided not to touch the gingival border of the bands, and these stayed, during numerous months, without giving any trouble. This case and others similar to it decided me to festoon less and less the gingival border of the bands in the interproximate spaces. This modification of technic was not followed by any grievous consequence. If it would be necessary to cut off, on the bands of mandibular first molars, every part situated more than one millimeter under the gum, very often little would subsist mesially and nothing distally. Hawley* uttered a similar opinion: "One can place a band under the gum and still not cover all the enamel, and there is no danger at all."

Let us compare now the shape of the band with that of the crown of the tooth upon which it must be placed. The crown of the first mandibular molar presents a bulge, over and under which it becomes gradually narrower. The band gets nearly uniformly larger from occlusal to gingival. Near its middle part it has the width of the greatest circumference of the tooth to which it is destined, and consequently is there correctly constructed. In its occlusal part it gets narrower and in that respect its form is in harmony with that of the tooth. In the gingival part the band becomes gradually larger, while the corresponding circumference of the tooth gets gradually smaller.

If one drives with some force upon a tooth a band of a width of 4¼ mm., it will fit pretty exactly near the occlusal surface and nearly exactly at the height of the contact points. The gingival part will remain suitably in contact with the buccal surface of the tooth which forms, in its general lines, an inclined plane; it will stay at a feeble distance of the mesial and distal surfaces, which are slightly convex or flat, where they are covered by the band, and will be passably far from the lingual surface. Indeed, the most prominent part of this surface is situated in the middle of it or nearer to the occlusal margin, and gingivally this surface is flat or more or less concave. A band conformed in that manner presents very bad conditions of equilibrium. The danger is great that a force bearing upon the occlusal border, on the lingual side, shall bring down and tip off on that side the band, which is badly sup-

**Dental Cosmos*, 1916, p. 1068.

ported in the gingival region. The defect of such a band being evident, attempts are made to remedy it. The manipulations of adjustment generally resorted to comprehend the use of burnishers and of contouring pliers.

Let us firstly consider the effects of burnishing. At the level of the occlusal part of the tooth, where the difference between the circumference of the band and that of the crown is very slight, it improves notably the adaptation of the band. At the level of the gingival part the metal is at such a distance from the tooth that no burnishing is able to reduce the excess of metal. The burnishing goes together with the use of contouring pliers. Pullen publishes a figure in which the special contouring pliers used by him are applied on a molar band (Fig. 5). The result of such an application is a widen-

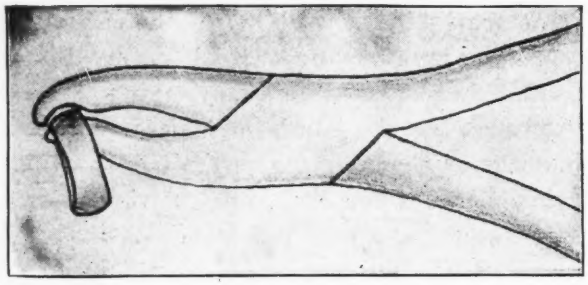


Fig. 5.

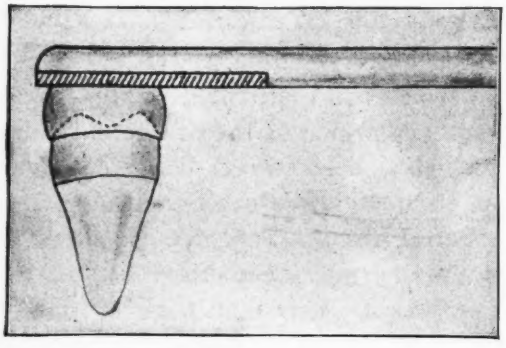


Fig. 6.

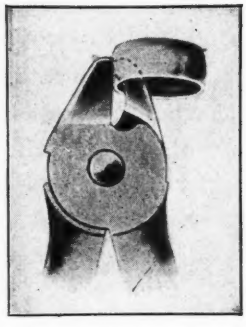


Fig. 7.

ing of the middle of the band and a reduction of the occlusal and gingival circumferences. After such a modification the band corresponds very imperfectly to the anatomic conformation of the crown of a first mandibular molar. It is especially worth notice that the contouring pliers, applied as they are, widen a part of the band already sufficiently wide. Fig. 6, taken from the same author, shows a band adapted in this manner and being placed upon a first mandibular molar of a surely very exceptional form.

Fig. 7 shows, after Waugh, a pair of pliers of Mershon contouring a molar band. The effect of such an application is nearly the same as that shown in Fig. 5.

I proceed in the following manner. The band being soldered and eventually festooned, I adapt as well as I can the gingival part with contouring pliers, such as Reynold's pliers used for making crowns, taking in considera-

tion the anatomic characteristics of the tooth operated upon. I strive to throw out of shape as little as possible the neighboring parts, which are liable to be warped by the action of the pliers.

The band is then placed upon the tooth. Pullen uses, to set the band, a steel instrument with a piece of pure tin soldered on the end to catch the edge of the molar band and prevent slipping. One can make a bandsetter with the handle of a toothbrush or other bone object of appropriate form, in which one cuts, at one end, a step with a saw. When the band has been

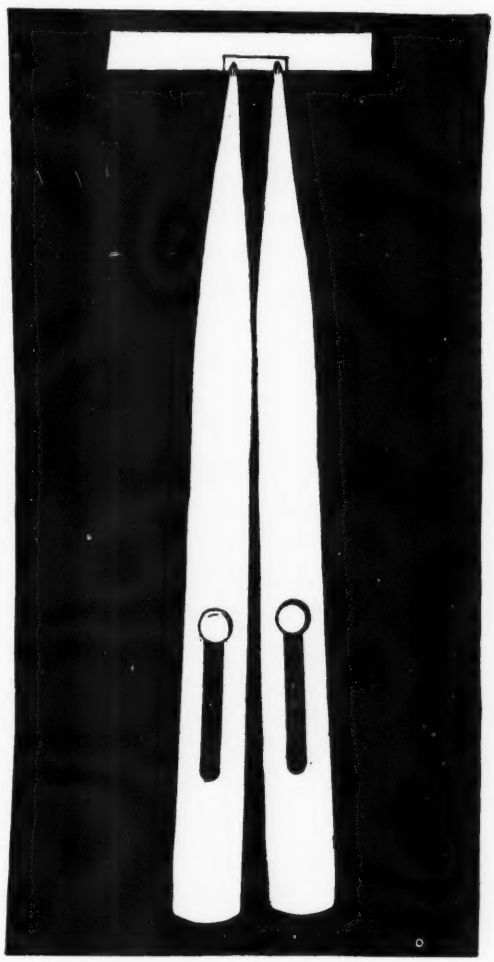


Fig. 8.

set, one tries to drive it down as much as possible with a metal or hardwood band plugger, upon which an assistant gives a few well-spaced and distinct blows with a mallet. When the band is well down, one gives with the same instrument a few blows on the height of the buccal and distobuccal grooves, in order to adapt the metal in those places. One takes then an instrument of appropriate form and burnishes all the occlusal half of the band and the gingival part on the buccal side. After such an adjustment the greatest part of the band is suitably adapted to the crown of the tooth. The gingival part still lacks adaptation on the mesial, distal and lingual sides. From that

moment I gave up the use of burnishers and contouring pliers, the action of which is not sufficient or not sufficiently precise, and I endeavor to finish the correction as much as possible with the aid of a completely controllable process.

The band has firstly to be taken off. This being done, I take a strip of German silver (platinum gold can, of course, also be used) 0.20 mm. thick, 7.5 to 8 mm. long and 1½ mm. broad, and I place it on the inside of the band lingually, near the gingival border. I put borax on the surfaces in contact and I place, near each extremity of the strip, soldering pliers with sliding catch. I obtain in this manner in a short time a very exact adjustment of the strip against the inside of the band. Fig. 8 shows such an application upon a band previously opened and spread out. One brings then in the fine flame of an orthodontic blowpipe the part of the band upon which it is intended to make the soldering. This gives a very strong adhesion of the reinforcing strip to the band. Afterwards I solder with wire solder fixed in a holder. The band is then boiled in a solution of alum and shaped with the aid of carborundum stones. The parts of the reinforcing strip which eventually go beyond the band are ground off, and a uniform thickness is given to the band gingivally. The upper part and the extremities of the strip are then ground in order that they continue everywhere imperceptibly with the band.

It is interesting to follow the placement of such a band upon an extracted tooth. One sees the whole gingival circumference tightly fitting against the tooth, which shows that a greater narrowing of this circumference would have rendered the placement of the band impossible. Then, with the aid of a few mallet blows given upon a band plugger, the band goes down and takes the place which it occupied before its reinforcement. The gingival strip draws lingually the mesial and distal parts of the band, and improves notably their adaptation. Lingually it presses close upon the lower part of the convexity of the lingual surface and follows the depression on this surface near the gingival line. The band gains in this manner a hold which remedies its great tendency to tipping off on that side, and its weak point is suppressed. One would be tempted to carry on further the correction by the burnishing of the mesial and distal gingival parts. But what is gained in this manner on one side is lost on the other side of the circumference. The same things happen, of course, when the band is placed in the mouth.

We have still to direct our attention to the occlusal border. If some part of the upper border extends on to the occluding surface, it must be cut away. The application of a part of the band upon the occluding surface, as it is advised by some authors, is, I think, faulty. When a part of the band comes higher than the level of the occluding surface, it is submitted to the action of the antagonist teeth and is soon stretched and contorted. When the band covers a part of the occluding surface, the cement placed between it and the tooth is disintegrated and the metal is soon deformed and torn.

After the described manipulations the occlusal circumference of a mandibular first molar band fits most often closely to the tooth. If this is not the

case and it forms somewhere a wrinkle or a small pocket which it has not been possible to reduce, one must take care not to pinch the band and fuse solder afterwards in the inside of the pinch, as is recommended by most authors. J. T. Quintero advises in such cases to incise the band, to burnish the metal upon the tooth and to solder the superposed parts. This manner of proceeding is excellent.*

A band conformed in the described manner is perfectly adapted to the greatest part of the crown, and I think that it would be difficult to give it a better adaptation. It is worthy of note that the band adheres to those points on the tooth that are usually found to loosen in other methods. A band adjusted in this manner and reinforced holds very strongly to the tooth, and a serious effort is generally necessary to detach it, even in the absence of any fixation by cement.

V. BANDS FOR THE UPPER FIRST MOLARS

For these bands, as for those of the mandibular first molars, the anatomic conditions must determine our manner of proceeding. Four surfaces are of interest for us: the buccal, lingual, mesial and distal surfaces.

Fig. 9. (After G. V. Black.)

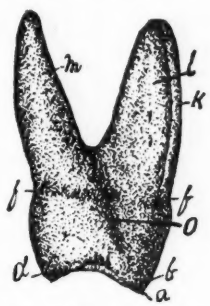


Fig. 10. (After G. V. Black.)

The buccal surface (Fig. 9) is irregularly convex. On the occlusal side it is much wider than on the gingival side. After Black, the difference in the width is equal to three-tenths. For the first mandibular molar, the same author admits a difference of two-sevenths. This surface presents a slight inclination downward and inward, which is favorable for the fixity of the bands. There is a marked groove, the buccal groove.

The lingual surface is made of two lobes, a mesial and a distal lobe, separated by the lingual groove. Both lobes are smoothly convex from mesial to distal, and in a less degree from the gingival line to the occlusal margin. Many maxillary first molars have a fifth cusp, situated on the lingual side of the mesiolingual lobe and more or less developed. The lingual surface has a big slope directed downward and outward. A band going up on such a surface stretches itself more and more and has no tendency to tip off on this side. The same thing exists at the mandible, on the buccal side.

The mesial surface is nearly flat in all directions. In many molars, near the gingival line, half-way from buccal to lingual, this surface is a little concave.

*J. T. Quintero, "Procédé d'ajustage des bagues sur les dents," *L'Orthodontie française,* Vol. II, pp. 54-56. Lyon: Editions de la Province Dentaire, 1923.

The distal surface (Fig. 10) in its lingual half is convex in all directions, but in its buccal half there is often a concavity formed by a considerable distal protrusion of the distolingual lobe. This concavity and the fact that in its immediate neighborhood the buccal surface is relatively narrow, are the cause of very unfavorable conditions for the good adaptation and for the fixity of the bands.

Fig. 11 gives the result of measurements of the circumference of three maxillary first molars, taken at four different heights. The first line represents the length of the circumference in the neighborhood of the occlusal surface, the second gives this length at the height of the proximate contact points, the third, at about 4¼ mm. from the occlusal surface, and the fourth at the level of the neck of the tooth. The relations between these different lengths are nearly the same as for the first mandibular molars.

Nevertheless, the bands for the maxillary first molars do not tend so much to fall off as those of the mandibular molars. Generally they get loose, not on the lingual side, as is the case of the bands of the first mandibular molars,

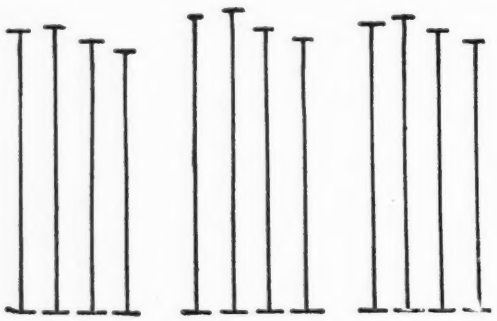


Fig. 11.

but on the buccal side. If these bands stay better than those of the first mandibular molars, it is because the buccal surface of the maxillary first molars presents, together with very unfavorable dispositions, an advantageous general inclination.

I apply on the inside of the bands of maxillary first molars a reinforcement strip similar to that which I solder on the bands of first mandibular molars, but I place it, not on the lingual side, but near the gingival border *on the buccal side.* The adaptation of the occlusal part of these bands takes place in the same manner as for the first mandibular molars. The burnishing, however, gives generally a less good adaptation of the band to the whole circumference of the tooth than at the lower jaw, specially round the distolingual angle. There the proceeding of J. T. Quintero, consisting in the cutting of the band, in burnishing the metal on the tooth and in soldering the superposed parts, is particularly precious and can very much contribute to assure a complete adaptation.

VI. BANDS FOR THE ANTERIOR TEETH

Contrary to the opinion expressed about the molar bands, I think that it is very important to festoon the gingival border of the bands for incisors

and canines on the mesial and on the distal sides, until it passes as little as possible under the gingiva. If one leaves even a little of the metal at this level, one risks provoking an irritation of the gingiva and of the periodontium, with permanent redness and congestion which may have severe consequences.

The proceeding of adjustment of bands by J. T. Quintero, consisting in cutting these in the corners where there is too much metal, applies not only to the anchor bands on the molars, but also to those that can be made on all the other teeth. There is as a rule no reason to solder a reinforcement strip on the inside of a band for an anterior tooth. In some cases this can be useful. Moreover, it happens sometimes, when one has made an apparatus with bands on incisors or canines—for instance, a retaining apparatus made of two bands united with a piece of wire—that, on trying the appliance, a lack of fixity of one or two bands is remarked. In those cases one can obtain excellent results, if the bands have been constructed carefully, by soldering against the gingival border, on the inside of the band or of the bands that are too large, a small reinforcement strip. I give to such a strip a thickness of 0.10 or 0.12 mm., a width of 1 mm., a length of about 3 mm., and I place it most often on the distal side, sometimes on the mesial side, depending on the degree of adaptation of the band in those places. I put borax on the surfaces of contact between the band and the strip. I maintain the latter in its place with soldering pliers and I make the borax melt. Then I unite with wire solder, fixed in a holder, the band and the reinforcement strip. When the apparatus is placed again in the mouth the fixity is generally perfect.

VII. ADVANTAGES OF GOOD TECHNIC

If I am not mistaken, the application of the technic described in this paper may greatly modify the practice of orthodontia. With the technic generally applied, the repair of accidents happening on bands constitutes, according to the opinion of numerous expert practitioners, a serious element in the practice of orthodontia, a kind of mortgage upon this specialty. I think that this factor can be nearly eliminated. It happens for weeks on end, that no patient appears with a loose band. Many hours become free in this manner and can be employed more usefully and more agreeably than with annoying repair work.

The fixity of the bands is very important for the regular course of treatments. It is essential that the apparatus should work continually in the direction of the pursued aim and that at no instant should a tooth be able to go back in its previous position. Any modification in the technic which may increase the fixity of the apparatus contributes greatly to augment its efficacy. The length of time needed for treatment can thus be shortened and the results can become better.

A great fixity of the bands was already very desirable with the use of labial arches of about 1.3 mm. in diameter. It has become of much greater importance since the extension of the use of the ribbon arch and of the lingual arch, which necessitates the soldering, on the bands, of tubes in which arches

or wires engage with great precision. Repairs are, in these cases, much more difficult than when labial arches of 1.3 mm. in diameter are used.

For the patients also the sureness of the orthodontic technic is an important factor. Very often they have to make long journeys to visit the specialist whom they have chosen. The pecuniary charges they have to bear may be great and are increased by the imperfections and faults in the technic followed by the operator. Every coming off of a band may necessitate a costly journey for two people often at an inopportune moment.

As I pointed out at the beginning of this paper, the adjustment and the placing of bands constitute a great part of the office work of the orthodontist. A modification in the technic allowing the execution of such work with a greater certainty must inevitably prove of great advantage to the practitioner.

DISCUSSION

The *President* said bands played a great part in orthodontic work, and it was impossible for anyone to deny the fact that very often the bands could be got off by the patients under treatment. Anything which such an authority as Dr. Rubbrecht said about the matter must be believed and taken for granted. All the members would go home very much richer in their knowledge of the subject after having heard the paper, and the members thanked Dr. Rubbrecht very much for his communication.

Dr. A. Kadner (Hamburg) said after he had seen one of Dr. Rubbrecht's demonstrations he had proceeded to make similar bands, which he had found of the utmost possible use.

Dr. Dullemond (Utrecht) remarked that two years ago Dr. Rubbrecht had been kind enough to invite her to Ghent in order to show her how he made his bands, and ever since then she had made her bands in the same way, with the most satisfactory results. The bands had never come off after that time.

Dr. Rubbrecht, in reply, said the president had remarked that everything he had said to inquire into his methods themselves and draw their conclusions, and then he was sure that the members had to believe, but he did not ask them to do that; he merely requested them they would believe what he had said.

THE GROWTH OF THE ALVEOLAR BONE AND ITS RELATION TO THE MOVEMENTS OF THE TEETH, INCLUDING ERUPTION*

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(Concluded from May issue.)

THE CONTINUED MOVEMENT IN THE ALVEOLAR BONE OF MOLARS IN INDEFINITE SUCCESSION

IN DISCUSSING the question of the movement of teeth growing from persistent pulps I gave it as my opinion that "a consistent theory of the movements of the teeth must not only account for the ordinary movements of ordinary teeth, but must also offer an explanation of all special cases." Before leaving this account of the forward movement of the teeth in the alveolar border, I must, therefore, make reference to the parallel case of the indefinite succession of the molars which is to be observed in certain animals, notably in the manatee. I have indeed previously suggested that the explanation of the apparently endless series of molar teeth, which in these animals appears from the remarkably independent end of the alveolar process projecting backwards through the dental foramen in the mandible and from the persistent alveolar bulb in the maxilla, is probably that the teeth do in fact what they appear to do—travel forwards in the alveolar bone, the worn-out teeth being shed from the anterior end of the series and their place taken by those coming forward from behind. This was no novel suggestion, as Oldfield Thomas and Lydekker had been forced to this conclusion in 1897 by their examination of a series of the jaws of manatees of different ages. But they were concerned principally to demonstrate that, however old the jaw of the manatee may be, there are always to be found new molars developing in the alveolar ends, and they did not discuss the mechanism of the forward movement or attempt to relate it to the conditions in the jaws of other animals.

I have now no doubt at all, in view of the results I have obtained in the pig, that if the madder method could be applied to the manatee, all the interalveolar septa would display unequivocal new bone on their proximal surfaces and absorption areas on the distal. Observation can indeed be made on these surfaces without madder, though lacking its dramatic effect, and a simple inspection of the interalveolar septa of the manatee proves beyond a shadow of a doubt that bone deposition and absorption have been proceeding in the situations specified (Fig. 22). Every molar alveolus in the manatee is in this respect the same; the proximal wall displays the irregular pitted surface which is characteristic of absorption, while the distal wall is covered

*Read before the British Society for the Study of Orthodontics.

by new bone arranged in a regular series of horizontal ridges which extend just to the labial and buccal walls where they end in a continuous sharply raised edge which has obviously been slowly creeping forwards. Thus forward movement of the teeth themselves becomes the sole cause of their displacement relative to the coronoid and the malar process after the full growth of the jaws has been attained, and another special case is brought into line with a general principle.

This simple observation opens to us a wide and fascinating field of comparative inquiry, by which in the end all manner of variations in tooth position and tooth movement may be brought together and explained by the general principles of bone growth; but enough has been said for the present.

THE CHANGES IN THE CRYPTS OF SUCCESSIONAL TEETH IN RELATION TO THE MOVEMENTS OF THEIR PREDECESSORS

Having now dealt in turn with the general arguments for the movements of the teeth in three different directions in the alveolar border, it remains

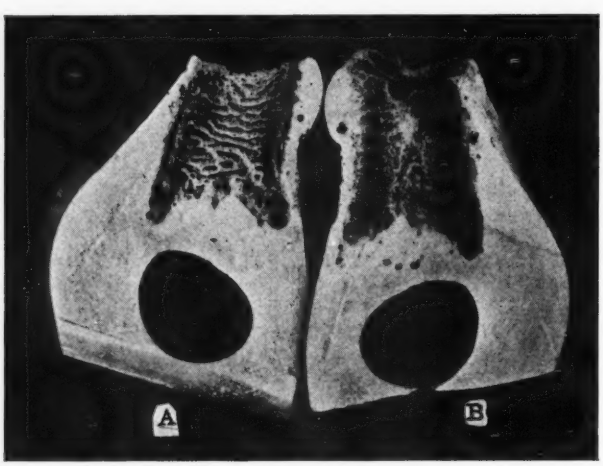


Fig. 22.—The walls of the distal alveolus of the sixth molar tooth in series from the right side of the mandible of a manatee (*Manatus Americanus*). (*A*) Distal surface showing the transverse ridges of new bone ending on both lingual and buccal sides in vertical advancing edges; (*B*) proximal surface showing the characteristic pitted appearance which denotes bone absorption. All the alveoli, maxillary and mandibular exhibit the same appearances.*

only to make some brief observations on the changes undergone by the crypts of the successional teeth in relation to the combined movements of the predecessors, so that we may be in a position to take a complete view of the principles which underlie the actual eruption of the teeth in the light of the whole history of their movements in the alveolar bone.

The enlargement of the crypts of successional teeth before "eruption" is definitely related to the direction of the movement of their deciduous predecessors. The constant movement of the deciduous teeth explains the relative position of their respective successors, the most obvious example being that from this point of view a new light is shed on the necessity for the lingual situation of teeth which are to succeed others which are constantly moving buccally.

*Very slightly enlarged.

As the growth of the jaws proceeds, not only do the crypts of successional teeth enlarge but they also "move" by absorption, and at certain stages by a change from absorption to bone deposit in the deepest part of the crypt or on one of its walls; the crypts with their contained toothsacs thus move in an upward, labial and proximal direction. This "movement," owing to the increasing size of the crypts in the early stages, is at first mainly an alteration of the position of their centers by "differential absorption" greater in that direction. The "movement" of the toothsacs, really in the three directions though apparently mainly towards the surface, being accompanied by increase in their size and related to the direction of movement of their predecessors, the absorption incidentally includes the roots of the latter. When the tooth is sufficiently developed, and the roots of the deciduous tooth correspondingly absorbed, the concealed movement of the toothsac, which in the later stages is due to a balance of deposit and absorption on opposite sides of the crypt, gives place to a manifest movement of the tooth by a change of the emphasis from absorption to deposit. The remains of the deciduous tooth are extruded in an upward and labial direction, the tissues of the toothsac are reduced to the alveolodental periosteum, and the rapid growth of the alveolar bone not only forms a socket around the tooth but raises it bodily to and beyond the surface.

This is the stage we call "eruption," but in the light of our new conception of the whole history of the continuous movements of all the teeth, it may now take its proper place in that conception as a mere phase of a general process, a phase which requires no special "theory" to explain it. The general process, of which "eruption" is the only part that has always been manifest and has therefore attracted attention, commences with the first formation of the crypt around the developing tooth, continues with the further excavation of that crypt and its enlargement towards a surface which is continually receding from it, and passes through the stage at which the tooth actually emerges from the bone into the continuation of the same process which is found in the continued rise and other movements of the erupted tooth thereafter with the continued growth of the alveolar bone. The slowing down of the process when the tooth is "fully erupted" is probably conditioned by contact with opposing teeth, and its final stage may perhaps be found in the further rise and final slow extrusion from the alveolar bone of teeth which are unopposed.

HOW LONG DO THE MOVEMENTS OF THE TEETH CONTINUE?

The conception thus completed by including "eruption" as a phase of the continuous movements of the teeth, and the facts of continued movement after "eruption," give rise to a final question to which I can make only brief reference; for to this question we are not yet in a position to give a detailed answer. How long do the movements of the teeth continue?

If, as is probable, they may all be included under a generalization which applies to the growth of the whole skeleton, and may be explained as part of the remodelling process which is a response to, and proceeds simultaneously

with, increase in size of the jaws, then it would follow that such movements of the teeth, maintaining their relative position as all parts of the jaws are maintained relative to each other, must in general gradually cease, as other remodelling processes necessarily do, with the cessation of growth.

Vertical movement is in this respect perhaps in rather a different category from the others, in that it is compound. The vertical movement which merely maintains relative position, and is therefore strictly comparable with labial and proximal, is perhaps to be regarded as superimposed on a more fundamental vertical movement which throughout the history of the tooth is responsible for an alteration in its relation to the surface. When opposed, as in the stages before "eruption" by the necessity for the absorption of bone and perhaps the roots of a predecessor, or after "eruption" by articulation with the teeth of the other jaw, this altering factor in vertical movement is slow working. It is most rapid during the unopposed period of actual "eruption," and again becomes manifest later if opposition be wanting. Thus vertical movements may be possible throughout the life of the tooth, though in later stages they may not be conditioned at all by general growth of the jaws.

It must also be remembered, apart from the difficulty of defining what we mean by "growth," that remodelling processes, with absorption in the principal rôle but accompanied by deposit of bone on a minor scale, may continue throughout life and become obvious and even dominant in old age as the response of the bones to changing conditions, such as alterations of stress and the shrinkage of soft organs. The general form of the skeleton must largely depend on the reaction of the individual bones in some mysterious fashion by bone deposit and bone absorption to the mechanical necessities of their own fundamental form as they grow in size, and to the physiologic strains imposed upon them by their relations to other bones and by the tone and coordinated contractions of the muscles. The response to such influences can never be merely local, but must always be in the nature of an alteration of the whole bone by deposit and absorption in appropriate situations, irrespective of the points through which strains are transmitted such as the articular ends or the attachments of individual muscles.

The jaws are no exception to these general principles thus lightly sketched, and it follows that throughout life, with slow changes in the strains and stresses to which they are subject, and with alterations in the articulation of the teeth brought about slowly by the consequent changes in the jaws, or rapidly with the loss of some of the teeth themselves, there may be associated the possibility of further movements as part of the continuous but slow process of remodelling and readjustment. It is difficult, therefore, to set a term to the possible movements of the teeth in any of the three directions, though we shall probably not be far wrong if we say that tooth movement as a constant process and a fundamental feature of the development of the jaws comes to a gradual cessation as they attain their full size.

It is of interest to note in this connection that R. Landsberger in two recent papers has described from the appearance of the alveolar bone in madder-fed dogs what he calls a "continuous growth change" (kontinuierliche

Wachstumsbewegung) in the alveolar bone. Dr. Landsberger specifically refuses to recognize the results he obtained as evidence of actual growth, for he was apparently not prepared to abandon the old conception of the permanence of the alveolar border once it is built up around the teeth and so long as the teeth remain. He therefore came to the conclusion that changes of extremely rapid alternate destruction and regeneration were constantly going on in the alveolar bone, determined, he even goes the length of speculating, by the alternate pressure and release of the teeth in articulation. It is clear, however, to me, after comparing the colored plates with which his first paper is illustrated with my own specimens, that he was merely demonstrating in the growing dog what I have demonstrated in the growing pig—that the body of the mandible and the maxilla increases in height at the alveolar border. He used the direct method, and the fact that the alveolar border was stained red he took as unassailable evidence that there must be a growth change in the bone which could not be a growth in the ordinary sense, since the teeth and the alveoli were already completely developed. ("Dies ist der untrügliche Beweis, dass in dem Alveolarfortsatz eine kontinuierliche Wachstumsbewegung im Gange ist, auch dann noch, als die Zähne und die Alveolen bereits fertig ausgebildet waren.") Yet it is obvious from his illustration of the mandible that the red border is much more sharply defined on the lingual side, and that with a similar strongly colored edge on the buccal side there is a gradual fading downward on to the outer surface of the jaw, which to me is evidence of continued slight movement in the buccal direction.

It is, moreover, curious that Dr. Landsberger should have come to the above conclusion in spite of the fact that his observations were made on two dogs, the ages of which were only five and eight months. It is a remarkable proof of the strength of the general belief in the absolute dependence of the alveolar bone upon the teeth, and its complete lack of participation in the general growth of the jaws and isolation from influences proceeding from increase in size, that he should have found himself unable to believe that the alveolar border was still growing in the dog at the age of eight months. It is further surprising to note that on this basis Dr. Landsberger stated in his first paper his definite opinion that this process continued throughout life ("der tatsächliche Beweis * * * dass sich in dem Alveolarfortsatz eine kontinuierliche Wachstumsbewegung zeitlebens abspielt"), and very interesting to find that he later found reason to alter this opinion; after examining the alveolar bone of older dogs by the same method, he devoted his second paper to this very point, and arrived at the revised conclusion that the "growth change" is in fact limited by age ("der Zeit nach begrenzt"), and that the critical period in the dog is about the sixth year.

The explanation is that his original specimens demonstrated not a mere "growth change," which may indeed exist, but the actual growth of the alveolar border. The fact that his older dogs did not give him the same result, coupled with my own as yet very limited observations on the jaws of pigs approaching their full size, justifies me in the belief that for all practical purposes the movements of the teeth which I have described come to an end when

the full size of the jaws is attained. Dr. Landsberger, on the supposition that the forty-fifth year in human age corresponds to the sixth year of a dog's life, also concludes that regulation of the teeth will be the more difficult the older a man is and the nearer he approaches that period, but that exceptionally after the forty-fifth year there may still be a "growth change," which may facilitate orthodontic procedures.

The phrase "for all practical purposes," which I have used above, is indeed no mere conventional one, but it is not for me, having treated this question as it must be treated in the first instance if the truth is to be found, as a purely anatomic problem—it is not for me to say what may be the exact bearing of the results which I have presented in this paper on the practical problems of the orthodontist. Having no experience in these matters, I do not know whether it may be found easier to move a tooth *secundum artem* in the direction in which it is naturally travelling at the time or against that direction, or whether such artificially produced, or controlled, movements may be equally successful while physiologic movements are still proceeding and after they have ceased. It would appear that after the full growth of the jaws has been attained orthodontic regulation is not so likely to be successful; but it may be that a knowledge of the continual tendency of the teeth to rise, and, when we are in possession of keys to the further history of the jaws, a knowledge of possible further movements of the teeth, perhaps in reverse directions in response to altering conditions, may enable the orthodontic surgeon to work in older persons as great changes in the position of the teeth as he even now does in the younger.

SUMMARY OF CONCLUSIONS AND THEIR RELATION TO THE CHANGING FORM OF THE ALVEOLAR ARCHES

1. Alveolar growth is the main, possibly the sole, factor in the growth in depth of the body of the mandible and maxilla. It continues throughout the period of growth of the jaws as a whole, which closes practically with the complete eruption of the third molars.

2. Associated with the general growth of the alveolar bone there are constant additions to the walls of the alveoli and the interalveolar septa which cause a constant movement of all the teeth upwards in the alveolar border.

3. Bone growth in relation to erupting teeth is essentially of the same nature, raising erupting teeth from their crypts to the level of those already erupted, which are also moving upward at a slower rate. The proximate cause of the eruption of the teeth is a local intensification of the general upward growth of the alveolar bone.

4. The roots of the teeth elongate at the same time, in the early stages being raised with the rest of the tooth as the crown travels a greater distance, at the end of the period of eruption growing down toward the mandibular canal or the maxillary canal and sinus as the crown continues to rise, but at a slower rate.

5. The growth of cementum is an additional factor in the upward movement of teeth both erupting and erupted. The relative importance of this

increases slightly with diminishing intensity of the general alveolar growth, but it is probably offset by the gradual diminution in the thickness of the alveolodental periosteum.

6. The constant forward movement of teeth with persistently growing pulps is probably due to enamel and cementum additions increasing slightly the diameter of their embedded portions in stationary alveoli; this takes the place of combined cementum and alveolar socket growth in the earlier stages while general growth is still proceeding.

7. There is a constant movement of all the teeth in the labial direction in the alveolar border of the pig during the growth period.

8. The molar teeth are also rotated by appropriate bone growth in their sockets so as to come into line. Mandibular and maxillary molars rotate in opposite directions, and these rotations are complete before the teeth rise to the occlusal plane and come into articulation.

9. It is shown from two different sources of evidence, with possible support from a third, that the teeth also move proximally in the alveolar border. In the mandible a proportion of the space required in front of the root of the coronoid for the erupting molars is thus acquired, and in the maxillae a part of the backward travel of the malar process accounted for.

10. This movement is greater in the mandible than in the maxillae, thus facilitating the change in occlusion which takes place in the transition from the deciduous to the permanent dentition.

11. It is suggested and conclusive evidence produced that bone growth is responsible for the forward movement of the teeth in the alveolar border, which results in the coming into place of molars in indefinite succession in the jaws of the manatee after their full size has been attained.

12. A consideration of the continuous movements of erupted teeth in three directions during the growth period, and of the relation between enlarging successional crypts and the movements of their deciduous predecessors, suggests that "eruption" is but the manifest phase of a process of movement which begins long before and continues long after it.

13. The first permanent molar cannot any longer be looked upon as a fixed point in any sense from which to measure or superimpose the alveolar arches. Its position, like that of any other point in the jaws, is relative only.

14. The general conclusion is that the alveolar arches are in a constant state of change. Not only is there constant upward growth, the actual plane of the alveolar border carrying the teeth with it being constantly renewed, but there is also a continuous movement of all the teeth in two other directions—buccal and proximal. The actual position of the teeth in the arch at any given time is the resultant of these three movements, the forward diminishing slightly the increase in width of the dental arch due to the upward and outward movements. Differential rates of movement in these three directions will bring about the changes to be observed in the normal development of the alveolar arches, and a disturbance of these movements, however caused, will readily account for anomalies in the shape of the arches and in the position of the teeth.

Detailed application of these results to the normal changes in the human alveolar arches must await a new series of measurements designed to elucidate this question on the basis of observed facts in the jaws of madder-fed animals. Meanwhile it is abundantly clear that the alveolar arches can no longer be regarded as stationary and unchanging, unaffected by the growth of bone, save only in minor degree and locally, as teeth in different places are shed and replaced. They must be considered, on the contrary, as in a constant state of change and reformation. The alveolar arch of the permanent dentition is *quite* a different thing from the arch of the deciduous dentition. The bone of which it is composed is *entirely* new, and although it may resemble the deciduous arch in general form and dimensions plus the added portions behind, yet it is not merely the deciduous arch changed a little in front and extended, but a new formation which has come into existence by the mechanism of bone growth here described, and in conformity with the general growth of the jaws of which it is an integral part.

The importance of these conclusions, if substantiated and accepted, in providing a conception of constant change in the arches, and constant movement of the teeth in the arches during their development, cannot be exaggerated. It is hoped that they may lead through future investigation to an understanding of the exact changes that are taking place in the human alveolar arches at all stages of their development, to a knowledge of the mechanism of departures from the normal, and finally, through discovery of the factors which influence normal and abnormal changes in the position of the teeth, to a complete rationale for orthodontic practice.

REFERENCES

Brash, J. C.: The Growth of the Jaws and Palate. Lectures on the Growth of the Jaws, Normal and Abnormal, in Health and Disease. Dental Board of the U. K. 1924, p. 23.

Idem: The Genesis and Growth of Deformed Jaws and Palates. Ibid. p. 67.

Franke, G.: Ueber Wachstum und Verbindung des Kiefers und der Nasenscheidewand, auf Grund vergleichender Kiefermessungen und experimenteller Untersuchungen über Knochenwachstum. Leipzig. 1921.

Keith, A.: Proc. Anat. Soc., Gt. Brit. and I., June, 1923. Jour. Anat., 1925, p. 72.

Idem: The Adaptational Machinery Concerned in the Evolution of Man's Body. Huxley Mem. Lecture., Nature, Supp., Aug. 18, 1923, p. 263.

Landsberger, R.: Die kontinuierliche Wachstumsbewegung des Alveolarfortsatzes. Deutsche Monatschr. für Zahnheil. 1924. Heft 3/4. p. 49.

Idem: Ist die kontinuierliche Wachstumsbewegung des Alveolarfortsatzes der Zeit nach begrenzt? Ibid. 1925. Heft 9. p. 257.

Thomas, O., and Lydekker, R.: On the Number of Grinding Teeth Possessed by the Manatee. Proc. Zool. Soc., London, 1897. p. 595.

Tomes, C. S.: Studies on the Growth of the Jaws. Trans. Odont. Soc., Gt. Brit. 1891-2, xxiv, p. 143; Brit. Jour. Dent. Science, 1892, xxxv, p. 433.

Idem: A Manual of Dental Anatomy. 8th edit. (Tims and Henry), 1923.

Tomes, J.: Dental Surgery (Lectures, 1848). 4th edit., 1897.

Wilson, Charles S.: The Temporo-Mandibular Joint and its Influence on the Growth of the Mandible. Brit. Dent. Jour., July 15, 1925.

Idem: On the Growth of Bone. Ibid., Jan. 15, 1926.

DISCUSSION

Sir Arthur Keith said that they would all agree that the knowledge of the growth of bone lay at the very basis of orthodontic art. It was really the science upon which that art was founded. It ought to be understood how this growth occurred, and particularly how the jaws grow, but above all it ought to be known exactly how the sockets of the teeth

were formed and how all that mass of bone which was called the alveolar bone was regulated in its growth. To his way of thinking, the communication which Professor Brash had made was the most important contribution to this knowledge which had been made in his time. He hoped the society would permit him for a moment to speak of the origin of the method of studying growing bone, because it might be open to some of them to question both the method itself and the animal which Professor Brash had selected for carrying out his experiments. This was the oldest of all the known methods of vital staining—which at this present moment was throwing such a new light upon the physiology of the body. The discovery of vital staining was made by a surgeon of Guy's Hospital, John Belchier, 190 years ago. John Hunter took it up and was able to show by means of specimens, which were still preserved in the Royal College of Surgeons, that in the process of building up bones there were two aspects to be considered, one of them the building up itself, and the other, much more important, the absorption or remodelling of bone. Without madder staining the enormous activity that was going on in all bone in health as well as disease would never have been known. Those specimens of John Hunter some eight years ago lost their color, and the speaker's colleague at the college, Mr. Burne, repeated John Hunter's experiments on three pigs. The speaker was rather interested by some new details which he noticed in these specimens and Mr. Burne then repeated the experiments and extended the time of madder feeding. From these results he saw certain facts which enabled him to say that he agreed with Professor Brash's deductions. Professor Brash had demonstrated these things with a finality which he did not think they attained at the college. For instance, the specimens of bone now lying on the table were more diagrammatic than anything attained at the college. It was in this way that his own attention was drawn to the extraordinary plasticity of the bone of the alveolar area, and his knowledge was augmented by observing what happened in the jaws of acromegalics. It was from the study of such cases that he learned that the whole dentition might not only be shifted forwards but be lifted up by half an inch. Half an inch of new bone could be laid down in the sockets of the teeth and the jaw remodelled without, as it were, a single tooth coming out. He said this by way of preliminary to show that in coming to deal with Professor Brash's results he could talk with some familiarity and could assure the Society that they were not only acceptable and reliable but absolutely sound. They represented, to his way of thinking, a permanent and final contribution to the knowledge of the growth of the jaws and especially the growth and eruption of teeth. The great new fact which Professor Brash had brought before the Society was the extraordinary plasticity and malleability of the bone of the jaws. This, he knew perfectly well, was not new to those practising dentistry because every one of them since starting practice had worked upon that as a basis, that the bone as well as the osteoblasts were really a kind of domesticated "animal" which could be coached and coaxed to do almost anything. He thought that in this respect those in orthodontic practice were ahead of the anatomists, but now the anatomists were getting "square" with them because they had been able to demonstrate, largely owing to Professor Brash's work, the extraordinary plasticity of bone. The teeth were moved in an upward direction, they were also moved forwards and laterally.

Professor Brash had come upon a difficulty which the speaker, and he thought Mr. George Campion also, had felt very much when they were making an investigation of the growth of the jaws and the face—namely, this very modern problem of relativity; that everything was moving and nothing was fixed. If they could only arrive at a fixed point it would be all right. But there was not any fixed point to be found in the jaws and the alveolar bone. The position of the first permanent molar shifted and was not reliable. He had tried to take certain points which might be fixed, but it was evident from the results of Professor Brash's method that the supposedly fixed points were not reliable, and one had to transfer from the jaws of the animal on which he had experimented to human jaws the results at which he had arrived by means of his madder staining. Some might ask whether the results which Professor Brash had obtained in pigs were transferable to human beings. The answer was that they were transferable, but with certain modifications. A great number of things had to be verified. The general thesis was proved, that the alveolar bone, like a great battalion of soldiers, could be drilled and moved into a position and would

move the teeth into any position; but in the pig's jaw there was a tremendous forward growth. There the forward movement of the teeth and of the whole alveolar region in the pig was infinitely greater than in the human jaw. An important discovery which Professor Brash had made was that there was no new bone being laid down along the lower border of the jaw in the pig. All the bone that was being laid down was alveolar bone, and had emerged gradually into the body of the jaw. That was true of the pig's jaw but not quite true of the human jaw. There were certain things which led the speaker to believe that there was actually a positive deposition of bone both along the lower border and also in the lower chin, and the human chin was very curiously moulded and was very different from the pig's jaw. Professor Brash had very kindly at the end of his paper summarized the whole of his observations. As to the plasticity and the movement of the alveolar bone, the speaker was in agreement, also as to the knowledge of bone growth being the foundation of the knowledge of the eruption of the teeth. Eruption of teeth was essentially a bone movement. He was also extremely interested to see that Professor Brash paid attention to an extraordinary condition which was found in lemmings. In their jaws the incisor growth was permanent, the roots shifting right back to the neighborhood of the articular condyle. One wondered how such a condition could have arisen, but once it was known how movable and plastic the alveolar bone was, it did not become so difficult to conceive the socket of the incisor teeth slipping back even to the condyle of the jaw.

The speaker had referred already to his observations in acromegaly, and these specimens helped one better to understand what occurred. There was one point which Professor Brash did not include as part of his paper, but which was of the utmost interest and on which the speaker would like to touch. He (the speaker) assumed, in common with other anatomists, that growth took place at the sutural lines of the skull. Professor Brash had come definitely to the conclusion that the sutural lines of the skull and of the face were really not growth lines, that is to say, there was no new bone intercalated in these sutures as such. All that took place there was a superficial growth—laying on of new bone outside, the old bone inside being absorbed. In this way one got growth without actual deposition of new growth in the suture. That was an idea towards which the speaker had been drawn for a few years, but he had turned it down for several reasons. Some day, by such a method as vital staining, one would get to know whether or not new bone was laid down in the sutural lines. He had been studying the growth of the skull a good deal, and from certain appearances which he observed he came to the conclusion that in the growth of the face and also the cranium there was a deposition of sutural bone, although that other process—superficial deposition on which Professor Brash insisted—was perhaps the more important of the two. There was to be found in the skull a most curious growth of bone. He had seen cases in certain people where the malar sutures were united, with a consequent arrest of growth. He was inclined to doubt very much whether Professor Brash would be able to follow out that thesis of his that the sutures were not really designed for growth. One case came to him from Egypt—the case of a child who was born with all the sutures obliterated, and in that child, although it had lived until its teeth had erupted, the skull had not grown at all. It might be said that the growth had ceased because bone was no longer absorbed from within, for theoretically one could see that it was quite possible to get growth of the cranial cavity without sutures.

He feared that he had not been able to add a single iota to what Professor Brash had laid before the Society. On no point was Professor Brash wrong, and on every point which the speaker had examined he found him right. He had laid the whole subject on a firmer and wider basis than before, and enabled a readier explanation to be given of deformities in the growth of the jaw and maleruptions of the teeth, especially in connection with the deposition of bone upon the increase of the alveoli. The increase of the upper alveoli, particularly when one got a deep narrow palate, was without doubt due to a failure of one of the processes of expansion to which Professor Brash had referred.

Mr. G. H. Northcroft said that they must all agree, without undue flattery, that this was a paper of the highest scientific value. The society might indeed be considered fortunate in being the recipient of the further researches of Professor Brash continuing his painstaking and valuable work initiated by the Dental Board and the Medical Research Council. In the

paper they were afforded a clear and reasoned statement concerning the growth of normal alveolar bone and nature's processes observed in the eruption of teeth from which, in time to come, they might hope to deduce the etiology of many of the departures from the normal, especially those involving the growth and development of alveolar bone. Indeed, it would be a fascinating privilege for the Society to follow up and apply this fresh aspect of a complicated subject, presented by such a careful observer and shrewd seeker after truth. It might be interesting to suggest one or two implications arising from the observed facts. The correlated rates of growth made for normality. Professor Brash emphasized a point noted elsewhere, that coordination of varying rates of growth at different points and different periods was the essential of the problem leading to eruption from a more or less horizontal position to a vertical one, and at last arranging the morsal surfaces of the teeth in a common occlusal plane. It was interesting to note that from an intensive study of occlusion at varying ages Friel had already deduced the forward drift of the teeth and noted the greater movement of those in the mandible. It was seen also that Professor Brash supported the view of the variability of the position of the first permanent molar, and claimed that the theory of "interstitial growth was founded on a misconception of alveolar bone growth." In dental literature the word "separation" was only used for spaces between teeth, and it led to some confusion of thought if this word was used in reference to maxillary width. With all due deference to other observers, Professor Brash included, the speaker had always claimed that the posterior surfaces of the second deciduous molars were not on the same vertical plane, and owing to the excessive curvature of this surface of the maxillary molar (under the gum at this stage normally) the erupting first permanent molar was given the desired trend towards normal occlusion. A widening of the arches would seem to be justified to the extent to which the labial movement of the teeth would have carried them under normal conditions, but it was impossible to say at present what this amount was for any individual case. Was it not possible that here was the reason for the relapse of "over-expanded" cases? Professor Brash spoke speculatively of the possibility of labial movement of the maxillary teeth controlling the same movement of teeth in the mandible. It would be agreed by all that this movement was very often in evidence, but the rate of maxillary expansion must be correlated to the mandibular alveolar growth. As a matter of clearness to the text it would seem better when discussing the inclination of the molar teeth that the long axes of the molars were given the same directions as the morsal surfaces, that is to say, backwards and outwards and forwards and inwards—a small point that would doubtless be corrected later.

It could not be denied that Franke was unfortunate in superimposing deciduous and permanent arches for comparative study; it tended to confuse thought. The labial movements of permanent incisors did take place and they were in quite a different relationship to the nasal spine and other structures than the deciduous ones. According to Franke one visualized the permanent teeth as taking up a position behind the deciduous ones, if they were there, which they knew was not the case. It gave him great pleasure personally to see that Professor Brash supported their nomenclature committee, and used the term "cheek teeth," much used by Osborne, but derided by some American authorities. He concluded by saying with what avidity the transactions would be read and reread by earnest investigators if they continued to include papers of this type, which he was rash enough to prophesy would go far to blaze the trail towards the elucidation of many of the most intricate problems connected with the etiology of malocclusions and the ultimate elimination of these perversions by prevention or rational treatment.

Professor William Wright (London Hospital) said that Sir Arthur Keith had characteristically opened his remarks by an historical reference, and he might perhaps be permitted to do the same. He had spoken of Professor Brash's contribution as being the most remarkable which had been made to the subject of the development of the jaws and teeth. It would be rash for him (the speaker) to differ in that respect from Sir Arthur Keith, but he would like to mention the work of two other men, and he felt quite sure that Professor Brash would regard it as a compliment to be associated with them. One of the two was Eustachius, and the other was John Hunter. Eustachius was the first to distinguish between the deciduous dentition and the permanent dentition, and John Hunter's

work, which of course would be familiar to all those present through Sir Frank Colyer's monograph, was also memorable. The work of these two men, together with Professor Brash's work, might be regarded as furnishing the greatest contribution to the study of this most important subject. Like Sir Arthur Keith, he had found great help from Professor Brash's summary, and so far as he had read the paper and summary he thought the only respect in which he differed from Professor Brash was in a phrase in the first part of the summary. Professor Brash said: "The alveolar growth is the main, possibly the sole, factor in the growth in depth of the body of the mandible and maxilla." The speaker agreed that it was the main factor, but he could not agree that it was the sole factor. He (the speaker) would argue that for the alveolar bone there must necessarily be a firm basal support represented by the compact bone of the lower margin of the body of the mandible, and he would infer that with the increase in the alveolar bone consequent on the progressive development of the teeth, there would be a *pari passu* increase in the strength and size of this support—an increase which would contribute something to the growth in depth of the body of the mandible. Professor Brash probably had some very good reason for his statement, but the speaker would like to question the advisability of using the phrase, "possibly the sole factor in the growth in depth."

Another point which was interesting to him, and might be interesting to others present, was the very persistent character of morphologic processes. If one went back, for instance, to certain fishes like the sharks one found the teeth coming forward and outward over the mandible in something like the same way in which Professor Brash had shown they moved in the human subject. To pass to much larger forms, in the manatee and the elephant, one got admirable examples of this forward movement of the teeth. He thought that the explanation which Professor Brash had given of the cause of eruption of the teeth, that there was a local intensification of the action of the osteoblasts in that region, was a satisfactory one, and he thought that it would be interesting to see the jaws of pigs fed on madder after certain of the teeth had been extracted. The growth of cementum and the rotation of the teeth in the sockets were also matters of great interest. One sometimes asked, like the man in the New Testament, for a sign from heaven, but if one were really looking for miracles it seemed to him unnecessary to look any further than the jaws and teeth of a child, say of five or six years of age. It was most extraordinarily impressive to contemplate these various osteoblasts acting, so to speak, like bees in a beehive or ants on an ant hill, working unceasingly and with such wonderful accuracy; because, in spite of what was often said to the contrary, it was by no means an uncommon experience to find a perfect set of teeth. And when one thought of all the actions and reactions which had taken place before that perfect set of teeth was produced, it seemed to him definitely that such processes were in the domain of the miraculous. One matter which Sir Arthur Keith had raised and which interested him was the question whether there was any growth at the sutural lines. Years ago he was present at the opening of a prehistoric barrow in East Yorkshire, from which he thought twelve skeletons were recovered. Seven or eight of them exhibited what was known as metopism—a suture in the middle line of the frontal bone. The two halves of the frontal bone had remained permanently separate. One noticed that in these skulls there was a much greater width in the frontal region than usual. The greatest transverse width of the cranium was as a rule in the neighborhood of the parietal eminences, but here the bifrontal width was very large, a condition which he was inclined to associate with the persistence of this metopic suture. He was aware that Professor Brash was working on acromegaly, and he thought it possible that by a study of the pathologic conditions in such cases as acromegaly, even further light might be thrown upon the growth of the jaws and teeth. In conclusion he wished not merely to congratulate Professor Brash upon work which stood with the work of Eustachius and John Hunter, but also to congratulate the Society on being able to encourage and assist such extremely useful work as that which constituted the basis of this paper.

Mr. G. Campion offered his congratulations to the Society on receiving such a paper, and said that there were one or two points which seemed to him to require a little further elucidation. Of course, Professor Brash would hardly expect all of them to part with their prepossessions and prejudices at once. There was the question of the stable base of the

mandible. The speaker did not quite feel able to accept what Professor Brash told them about that—that there was no such thing. He admitted of course, all Professor Brash's observations. He admitted that there might be no anatomic difference between the base of the mandible and the alveolar process. But if he asked for a definition the speaker would have to come to the terms of physiology and say that it was that part of the mandible which through life was kept in a continual condition of stress by muscular tension, so that what was an anatomic fiction might be a physiologic and clinical fact. But that was quite a small point, and the point about suture growth was one which Professor Brash still had under consideration and was going to elaborate at a future date. The speaker was prepared to accept almost everything that Professor Brash told them in order to get on to the great things which he promised them in the last paragraph—a complete rationale for dental practice. This part of his paper had been working in the speaker's mind and had even invaded his dreams. He dreamed that Professor Brash placed one day in his hands a pair of dental arches; that the units of these arches were perfectly proportioned the one to the other, and the arches were perfectly formed according to the data which he had been able to amass. He found to his delight on placing them in occlusion and moving them in articulation, that he had in his hands visible and tangible expression of the very highest imaginative conceptions of Mr. Friel. Then Professor Brash presented him to a face which, as he looked at it, seemed to have great elements of beauty but to be strangely wrong in some way, and he told him that this was a face devoid of dental arches, and that these two dental arches which he had placed in his hands were perfectly proportioned to the face, and he invited him to put them in their proper places. His (the speaker's) reply was that this was not one of his usual jobs, and that he would have to ask for the cooperation of others. Therefore he invited Mr. Badcock, Mr. Northcroft, Dr. Sim Wallace, Mr. Rushton, Mr. Chapman, and Mr. Friel, and they all met and considered the matter. Ultimately they came to a general agreement and placed the arches as they thought proper. Then they presented the result to Professor Brash and to another gentleman who came into the room and whom Professor Brash introduced as an eminent sculptor —they rather guessed it was Epstein, and so it proved. They invited Epstein to examine their work and to say what he thought of it. He studied it with deliberation from different points of view, and after a prolonged examination he expressed the opinion that they were wrong! That, of course, opened the way for a discussion, and a discussion ensued. He need hardly tell them that with such a galaxy of talent on one side and the genius and knowledge of Epstein on the other, the discussion was very illuminating. He wished he could give the Society an account of it, but that was impossible. He could only say that for brilliance, dialectical subtlety, and general inconclusiveness it might have extorted the admiration of the ancient Athenians! Well, Epstein's point of view was this, that they had placed the arches not quite far enough forward. He said that the face was not fully developed; that they had placed their small system of relativity in a wrong position in regard to his larger system of relativity; they had spent their lives studying the arches, while he had spent his life studying the face, and he said that they had put their units wrong. Who was right and who was wrong must remain among the enigmas of dreamland, but, speaking to men concerned in the practical application of this matter, he submitted that this problem with which they were faced was child's play compared with some of the problems which faced them in treating these cases in ordinary practice, especially in hospital practice. They found themselves confronted with cases in which the face was deformed, the arches deformed, and the arches having teeth altogether disproportionate to the size of the face. They found also arches decimated by caries, and when he personally found himself confronted with a case of that sort it did not help him to be told, "Oh, it must belong to class 1, or class 2, or class 3," and that one had only to decide which it was and prescribe the proper treatment. That reminded him of a story of paleolithic man. It was that the zoologists of that period used to classify the animals according to the respective length of their legs and their tails. If their legs were equal to their tails they were put in class 1, if the legs were longer than the tails, in class 2, and if the tails were longer than the legs, in class 3. In succeeding ages the zoologists had learned that this system required very considerable modification. He be-

lieved that in time to come the knowledge which Professor Brash was giving to them, and which they were slowly accumulating with regard to the growth of this larger system of relativity-entire face, would alter their classifications in orthodontics and would lead them to one which would enable them to apply with more precision and discrimination than they could at present the recent and brilliant contribution which Mr. Chapman had made to the etiology of the subject. He thanked Professor Brash for his paper, and suggested—a thing which Professor Brash probably already had in mind—that the madder experiments might be applied to, if not the anthropoid apes, at any rate to some forms of monkeys. This would add to their knowledge on the question of sutural growth to which Sir Arthur Keith had referred, and would bring the whole subject more within the conditions in which they had to deal with it in practice.

Mr. Sheldon Friel said: I should like to join in thanking Professor Brash for his paper. He has elucidated the manner in which the changes in the jaws and the relations of the teeth have taken place which have been very perplexing to us practitioners. Recently at the International Orthodontic Congress in New York I read a paper on occlusion and the changes which take place from infancy to old age, and I was very glad that Professor Brash has confirmed many of the points that I had brought out in that paper. The first two lines in Professor Brash's fourteenth summary are, "The general conclusion is that the alveolar arches are in a constant state of change." I used very similar words in the beginning of my paper in reference to occlusion—that it is ever-changing. I will try to show that the changes in occlusion are very similar to the changes that Professor Brash has shown in the alveolar bone.

In the first slide,* a drawing of the occlusal surfaces of the mandibular teeth with the outlines of the opposing teeth, the points and ridges of the cusps, of a child of three years of age, you see a definite occlusion, which is made all the more definite by the length of the cusps, sharpness of the ridges and the depth of the fossæ and grooves. Now between this age and about six years of age a great change must take place. Space must be provided for the permanent incisors. On an average the upper permanent incisors are nearly 8 mm. wider than their predecessors, while the mandibular permanent incisors are only 6 mm. wider, so that if no other change took place the lower arch would retrude in some direction behind the maxillary arch. Professor Brash has shown in his madder-fed pigs that the mandibular teeth are moved in a proximal (medial) direction a greater distance than the upper teeth. I came to the same conclusion from the examination of models of the same children at different ages, and that this forward movement of the mandibular teeth compensated for the greater increase in the size of the maxillary arch. The next slide shows the deciduous teeth worn, so that the cusps are almost flat, and that the buccal groove of the mandibular second deciduous molar is medial to the medial buccal cusp of the maxillary second deciduous molar. In order that this greater forward movement of the mandibular teeth may take place two conditions seem to be essential: first, a greater lateral expansion of the maxillary deciduous arch compared with the mandibular arch, so that as the mandibular arch comes forward the mandibular deciduous canines and molars will not occlude buccally to the maxillary deciduous canines and molars; and secondly, an attrition of the cusps and fossæ of the teeth, sufficient to allow of the mandibular teeth sliding forwards. The next slide shows a case of a similar age without wear of the cusps of the teeth. No forward movement has taken place, and there is an apparent protrusion of the maxillary incisors. I think that the cases we see of almost normal occlusion, but with a marked overbite of the incisors, must start with the want of forward and upward development of the molar region.

The next major change in the occlusion is after the loss of the deciduous canines and molars. On an average, the difference in the combined mediodistal diameter of these teeth is 1 mm. in the maxillary arch and 2 mm. in the mandibular arch, so that in both arches too much room is provided. In the maxillary arch this space is reduced very slightly, and in the best developed arches that I have seen a space is found between the canine and lateral incisor. In the mandibular arch, on the other hand, the first permanent molar

*Slides were shown but not reproduced.

drifts forwards, and one gets the triangular ridge of the mediobuccal cusp of the maxillary first permanent molar more definitely in the buccal groove of the mandibular first molar. The next two slides show the forward movement of the mandibular first molar.

Professor Brash has referred to the time that the movements of teeth cease, and he seems to consider that it ends with the eruption of the third molars. A change in the relation of the mandibular to the maxillary teeth does occur in old age, but I think it is associated with wear. In primitive races and early man the mandibular arch does come forward in relation to the maxillary arch when the molar and premolar teeth are greatly worn. This mechanically allows the mandible to swing more forwards and upwards, and consequently the mandibular incisors wear more heavily on the maxillary incisors and the cutting edges are worn away, producing the edge-to-edge bite. We are all very much indebted to Professor Brash for his work.

Mr. Wilson Charles said that he was sorry that he had omitted to notice the reply in the British Dental Journal to the paper which he wrote some time ago on madder feeding. He felt that on this occasion he need not refer to the madder method, not, perhaps, because he could not reply to what had been said, but because he found himself so nearly at the same conclusions which Professor Brash had reached, that instead of arguing about the subject he was able to support him whole-heartedly. The first point to which he would like to draw attention was the fact that the first permanent molar was not a fixed point. The way in which he had arrived at that conclusion was somewhat different from that taken by Professor Brash. It was set out in the paper which he read at the annual meeting of the British Dental Association, when he described his conception of how the growth of the jaw took place, how the condyle pushed the mandible forward and the teeth grew up in that direction. That, apparently, had given rise to the idea that he regarded the mandible as a long bone, but in fact he had no such idea. The growth of the body of the mandible took place in one direction, and the condyle in another direction, not in one continuous line, and the erupting teeth were coming forward so that one had the gradual uprising of the alveolar bone.

Sir Arthur Keith asked whether the speaker held that there was no movement in the coronoid process at all.

Mr. Wilson Charles replied that there was a certain amount of absorption, but that was not the main way in which the process was moved. The only other point on which he had to speak was Professor Brash's last statement that "the importance of these conclusions, if substantiated and accepted, in providing a conception of constant change in the arches and constant movement of the teeth in the arches during their development, cannot be exaggerated." It appeared to him to be definitely certain that the conception which Professor Brash had brought forward was the correct one, and he could only say that he would like to join heartily in the congratulations.

Mrs. Lindsay said that she rose with great trepidation to take part in the discussion with so many distinguished authorities, more especially because one by one most of the points which she had had in mind had been dealt with. She had been reading a paper by Sir Charles Tomes, written in 1885, on the reformation of bone, and it seemed to confirm what Mr. Campion had said that evening. The paper by Sir Charles Tomes mentioned an interesting case, in which not only was the entire body of the mandible reformed after excision, but also the alveolar bone grew up round the teeth which had been left to the mucous membrane. The specimen is in the Bellevue Hospital Museum in New York at the present time. There was also a case treated by Sir Charles Tomes himself for syphilitic osteitis of the mandible, where the alveolar bone was entirely swept away and the basal bone, which remained healthy throughout, was left. That seemed to suggest that not only in respect of elasticity was the alveolar bone different from the rest, but also in susceptibility to disease. It reminded one of Metchnikoff's point that the parts so susceptible to disease were disharmonies to the whole organism, and Metchinkoff noted the teeth as a disharmony. Professor Brash had said that the alveolar bone was continued into the coronoid process. She had had great difficulty for many years in understanding a case which was illustrated in Sir Frank Coyler's book, of the eruption of a wisdom tooth into the notch between the coronoid process and the condyle. Professor

Brash spoke of the mandibular wisdom tooth in its crypt, and in course of eruption coming down into the jaw, apparently in the opposite direction, to eruption. Could it happen that instead of turning down towards the body of the jaw the tooth in this case had turned up into the ramus, and how did he explain it traveling right up to the notch, the ramus having been formed before the bony crypt of the tooth? In conclusion she would like to thank Professor Brash for the abundant food for thought which he had provided from his first Dental Board lecture until now, and to express her great admiration for the beautiful specimens by which his paper had been illustrated.

Mr. Robert Lindsay also joined in the appreciation of Professor Brash's paper. The paper had made him think, and, happily, the more a man thought, the less, usually, he felt inclined to speak. He was driven back upon Professor Brash's Dental Board lectures, and from there by a natural process to the work of Franke. He thought that in the Dental Board lectures Professor Brash had laid down the line of development which might naturally be expected, and the further investigation upon which the present paper was based indicated the point which had now been reached. There was one or two differences. If he remembered aright, the cutting back of the coronoid process was rather more emphasized in the Dental Board lectures than it is now. But even then, the movement of the teeth forward in the jaw by deposition of bone in the alveolar sockets was postulated, though there was at that time no evidence to support a positive statement. Franke's thesis, as they would all remember, was based upon the immobility of the first permanent molar, and it was no disrespect to that very remarkable man, whom one admired more the more one read of him, to recognize that he made a mistake, and that Professor Brash appeared to have demonstrated quite clearly that there was no such thing as a fixed point with regard to the first permanent molar, or, as Sir Arthur Keith had suggested, anywhere else in the organism. Franke, he imagined, fell into error by devoting his investigations almost entirely to the measurement of dried specimens, whereas Professor Brash had employed the vital method of investigating the problem. One felt that Franke overlooked the extraordinary activity going on in the growing jaw of the young child, well likened by Professor Wright to the activity of a hive of bees. Considering the whole thing as a measurement of dead materials, Franke was led into error. He (Mr. Lindsay) agreed with Mr. Campion: they had always been led to associate the alveolar process intimately with the teeth and to expect that when the teeth were lost the alveolar process would be lost also, while the jaw still continued to perform to a certain extent its functions. It was a little difficult for them to conceive that the whole of the important growth with reference to the mandible was concentrated upon the upper margin. But, like Mr. Campion, after full consideration of the various points in the paper, with which he would not attempt to disagree, he came back to the conclusion that the great matter of interest for a society like this was its effect upon the future practice of orthodontics. He had listened in that Society to a number of very interesting and very important communications, and he had had the opportunity, as also had some other members, of hearing and seeing in America some of the results of interference with the teeth for the purpose of regulation. These results, he thought, must impress them with the possible danger of injudicious movement of the teeth, and he hoped it had impressed them also with the feeling that the great line to follow in the future would be what might be called preventive orthodontics. Professor Brash's paper supported that view.

Professor J. C. Brash, in replying, on the whole discussion, said that his first duty was to thank most warmly all those who had taken part for the very kind things they had said about his paper. Some very high compliments had been paid him. Professor Wright had reached almost the high-water mark by associating him with Eustachius and John Hunter, but Dr. Lindsay had even surpassed this by saying that he (Professor Brash) had made him think!

He would like also most sincerely to thank the Society for the opportunity which had been afforded him of bringing forward this work, and for the honor they had done him in devoting two whole evenings to his paper and to the discussion. Many points had been raised in the course of the discussion, and he was afraid it was not possible for him to deal with them all, so he would just go through his notes and take them as they arose.

Sir Arthur Keith started with the historical view and told them about the discovery of madder feeding by Belchier. He did not discuss that in his paper, because he had previously done so in his Dental Board lecture. He had been investigating the origin of the staining of bone by madder, and he found that it was in fact well known in ancient times. There were some classical references to this property of madder. One of the chief points that Sir Arthur Keith had made was whether these results in pigs could be transferred to the human subject. That, of course, was a question for further investigation. What he hoped to do next was to attempt to apply the results which he had got in the pig to the human jaws and skull, and there, of course, since as yet they were not able to apply the vital staining methods to the human bones, would come in the importance of that great series of measurements which Sir Arthur Keith and Mr. Campion gave in a paper to that Society some years ago. Sir Arthur Keith had mentioned the lower border of the mandib'e; he seemed to agree that there was very little growth on the lower border of the mandible in the pig. Whether this was so in the human mandible he (the speaker) could not say, because he had not yet got to the stage of applying these things in detail. He thought that Professor Wright subsequently referred to the various theories relating to alveolar growth, but perhaps he (Professor Wright) had missed the point that the growth upon the lower border of the mandible in the pig was a growth which was associated with the traveling back of the preangular notch. As the preangular notch traveled back there was an addition of the bone on the lower border which filled that up and replaced bone which had previously been removed. He thought probably it would appear that the same thing was applicable to the human mandible, because in the human mandible there were the same variations which he had observed in the pig. But these were points he had not yet investigated.

So far as the growth of the sutures was concerned, he must leave the discussion until a future occasion. Both Sir Arthur Keith and Professor Wright had mentioned this point and had perhaps tried to draw him a little. All he would say was this, that all the evidence against his view that Sir Arthur Keith had suggested—the changes in the form of the skull associated with the closure of cranial sutures and so on—could be equally well explained on the other view that there was no separating growth in sutures. If surface growth had ceased in a particular direction than the sutures in relation to that direction might also close. It was no proof that there must be growth in sutures to show that a particular form of skull was associated with the closure of sutures in a particular direction. Mr. Campion, so far as he could follow his excursion into dreamland, made the point—and a very good point it was too, and one which he with Sir Arthur Keith was responsible for calling attention to—that the growth of the jaws was only one part of the growth of the skull. But this particular paper was concerned with only a part of the growth of the jaws—the growth of the alveolar bone—and he thought he had indicated in references to the lower border growth and coronoid growth and to the question of suture growth, that the alveolar growth could not be considered by itself. This was undoubtedly only a part of the much larger question of the growth of the skull as a whole, and he did not think they would be able completely to understand the changes even in the alveolar border, and particularly the factors that conditioned those changes, until they did have a more thorough knowledge of the growth of the skull as a whole. The further line along which he hoped to work was this growth of the skull as a whole. Circumstances being what they were, he had devoted a great deal of attention to the alveolar bone, which was of particular interest to orthodontists, but in future he would give the alveolar bone a rest and would go on to the wider question, and then he might be able to come back to the alveolar bone again with further evidence which would help to place it in its true relation to the growth of the skull as a whole.

Mr. Campion had suggested that it might be possible to apply the madder method to some of the monkey tribe. This he had already arranged to do. He was beginning now to feed a number of monkeys on madder, but as yet he did not know whether madder would color the bones of monkeys or not. There were some differences in the actual effect of madder on the bones of different animals. The bones of the rabbit, for instance, were extremely difficult to stain with madder, and it was quite on the cards that the bones of monkeys would not stain. In the whole history of madder—and madder was used for

many years in the pharmacopoeia for all sorts of complaints, generally as an "alterative"—there was no record of any evidence of the staining of human bones by madder. What the reason for the difference was they did not know, whether it was a difference in metabolism or in the absorption of madder. One thing was pretty obvious, and that was that the different constituents of madder—this again was rather away from the main subject of his paper, but it was of interest—affected the bone in different ways, and purpurin was a much more powerful constituent than the other main coloring principle, alizarin, which was found in the madder root. It might be, therefore, that the monkey experiments would fail unless purpurin could be got into the animals by subcutaneous or intramuscular injections. He had been particularly interested in what was said by Mr. Sheldon Friel, who sent him a copy of the paper he read in America some time ago. He had had great difficulty in getting through the technical terminology, but he was glad to learn that there was a definite relation between this work which he himself had undertaken solely from the anatomic point of view to begin with, and the practical work of the orthodontist. Mr. Northcroft also referred to the paper from that point of view. He had, however, carried out the work entirely as an anatomist, and he held very strongly that work of this kind must in the first instance be done for its own sake, with the aim of finding the truth of these things, whatever the application might be to practice. But if the application to practice came along—the reward for having done the work would be so much the greater.

Mr. Wilson Charles very kindly said that he felt able to agree with him on most points, but left aside the question of the technic and the discussion of the madder method. The short reply which the speaker had written to the British Dental Journal had not yet appeared; probably it would appear in the next number, but he was quite sure that whatever difference had arisen with regard to the interpretation of the madder appearances, there was a fundamental agreement between the view which Mr. Wilson Charles had described regarding the growth of the mandible from the condyle and the view which he (the speaker) had suggested; but not yet discussed in detail, as to the actual amount of absorption that took place in front of the condyle. He agreed with Mr. Wilson Charles on that point, and their previous disagreement having been brought into the open, would, he trusted, now end. It related simply to the interpretation of the madder appearances in the specimens. One last point raised by Mrs. Lindsay was with regard to the base of the mandible being something permanent. This he could not believe, because the evidence was present in the specimens that there was nothing absolutely permanent in the mandible or in any part of the skull either during its growth or after the main growth had ceased. One thing of which he was convinced was that every part of the jaw was in a constant state of change, and he could not but believe that these changes were due to functional reasons; that whatever might be the conditions under which bone grew and was absorbed, some part must be played by changes in the function and by changes in stress for whatever reason. He could not believe that there was any point anywhere at all in the body constant and unchanging throughout the whole of life. This applied not only to the period of growth but even after full growth had been attained. Later in life there were changes in the jaws as elsewhere. Age changes were growth changes in another sense. Bone was plastic always, and in a constant state of change, and what they had to deal with was not something permanent, permanently holding the teeth in position, but something always changing in itself and therefore capable of alteration under the conditions which might be induced by their appliances for the regulation of the teeth.

Mrs. Lindsay had asked a question about the position of the molar in the sigmoid notch. He would suggest that that molar had reached the sigmoid notch in the same way that the canine tooth might find itself in the middle of the palate, which was a fairly common condition. He did not know what caused the bone to push the tooth up into that position, but the mechanism would be that instead of coming forward the tooth would be carried upward into the sigmoid notch.

The President proposed a vote of thanks to Professor Brash and to the other speakers in the discussion. The paper had been an epoch-making one, and the discussion had been worthy of it, and quite possibly would influence orthodontic thought all over the world.

The vote of thanks was carried by acclamation.

Case Reports

RESULTS IN ATTEMPTING TO MEET THE PROBLEMS PRESENTED IN CASES WHERE SOME TEETH ARE ABSENT*

Case Report From Practice of Drs. Ketcham and Humphrey

Compiled by Dr. William R. Humphrey, Denver

TREATMENT, in the following cases, was outlined with the purpose of securing for the patient: first, masticating efficiency and length of life of the teeth; second, harmony of the features. After carefully considering the problems involved, we have closed spaces in many instances because we believed this procedure to be the lesser evil.

Retaining spaces so that the missing teeth may be supplied by means of bridges is often the easier method of treatment and the temporary result may appear satisfactory. Our experience has taught us that we should carefully consider the length of life and usefulness of teeth supporting bridgework, because of the many likely causes of failures, such as abnormal and increased stress on abutments, and danger to the vitality of the pulp.

In closing spaces we must consider the possibilities of traumatic occlusion caused by possible malrelation of the cusps of the mandibular teeth when brought into occlusion with the cusps of the maxillary teeth.

An important point to consider in closing spaces is an x-ray diagnosis of the positions of the third molars. Usually a third molar, even though apparently impacted, will move into the space occupied by the second molar, after the second molar has been moved forward. We have had cases in which the radiograms showed third molars apparently impacted, where the posterior teeth have not been moved forward, which later erupted normally. We have radiograms of all cases reported, but space forbids their use.

Case A.—Class 2, second division, subdivision (Angle), Fig. 1, a boy twelve years of age when treatment was started. He was treated by Dr. Ketcham in 1905 with the Angle expansion arches. Only six months were taken for active treatment. The treatment was reported in a paper read before the southern branch of the National Dental Association (A. D. A.) at Houston, Texas, May 4, 1910, and published in the *Dental Cosmos,* September, 1910. It was reported as "A Case of Different Masticating Efficiency on the Two Sides of the Jaws, Due to Ill-Advised Extraction."

This treatment was started with the idea of gaining space for a missing mandibular incisor, but before treatment had progressed far, the plan was changed. The mandibular incisors and the right canine were moved to the left, and then the molars and premolars on the right side, which were distal, were moved forward until they were mesial to their normal positions by the width of one cusp.

*Case report read before the Twenty-sixth Annual Meeting of the American Society of Orthodontists, Chicago, May 2-5, 1927.

Fig. 1, lower, shows this case twenty-two years after treatment, and while it is not an ideal result, it is our belief that the best service has been rendered the patient. The radiograms show the bone and investing tissues to be in splendid condition, with the condition on the right side in which the

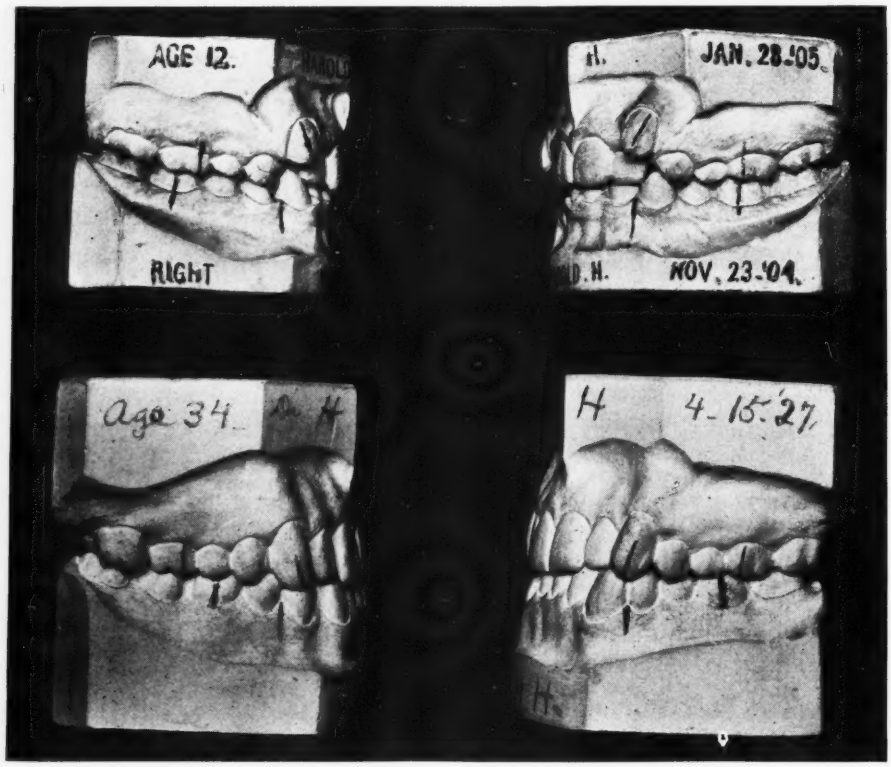


Fig. 1.

Fig. 2.

occluding teeth are not in normal occlusion, or in other words, are in traumatic occlusion, fully as good as on the left side, where the occlusal relations of the teeth appear to be normal. This case may be an exception to the general rule, for the radiograms show that there has also been but little suscepti-

bility to decay of the teeth, as there is but one small amalgam filling in his mouth. Fig. 2, upper, shows the face at beginning of treatment and lower, twenty-two years after.

Case B.—Fig. 3 shows the models of a boy twelve years of age when treatment was started in 1919, presented the problem of congenital absence of the mandibular left second premolar. In our consultation with the father, who was a dentist and especially skillful in replacing missing natural teeth by artificial ones, we explained the procedure of closing spaces, and the desirability of maintaining the normal occlusal relations of maxillary and mandibular teeth. To this explanation he answered that after having observed the comparatively short life of many bridges, he was in favor of closing the space.

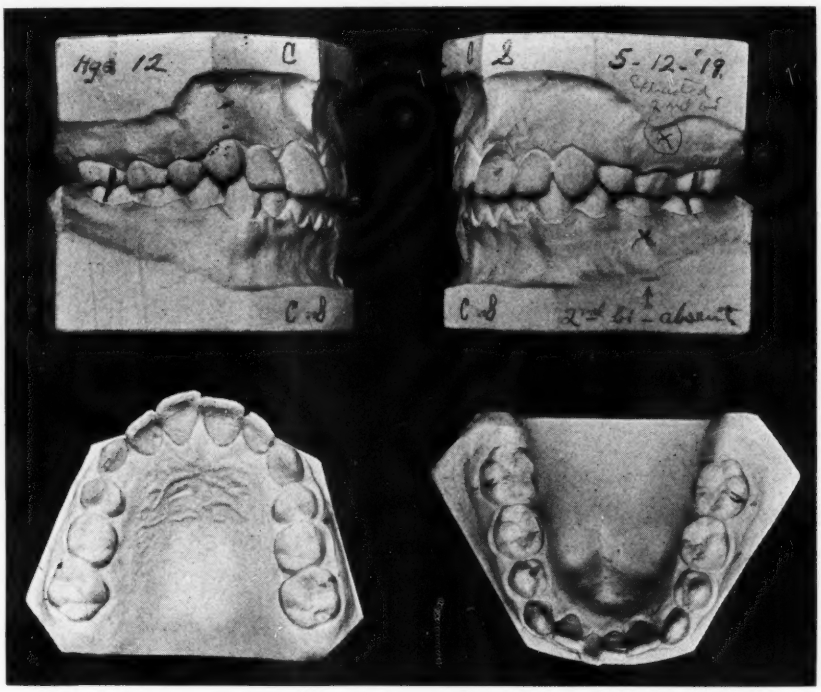


Fig. 3.

Treatment was outlined as follows: first, to extract the left mandibular deciduous second molar and then to move all the mandibular molars on the left side forward; second, to sacrifice the maxillary left second premolar and move all the left maxillary molars forward. By moving both the maxillary and mandibular molars on the left side forward, normal relation of these teeth was secured.

In moving the mandibular posterior teeth forward, the mandibular anterior teeth began to move backward. To overcome this movement, the lower labial arch was adjusted in such a manner that it stood away from the left cuspid and incisors, while being in contact with the teeth upon the right side. Thus, after attaching the teeth to the arch by bands and ligatures, one-half of the mandibular teeth from the median line back to the right first

molar were pitted against two or three teeth on the opposite side, and in this manner the teeth on the left side were moved forward. Fig. 4 shows the result in 1927, five years after treatment.

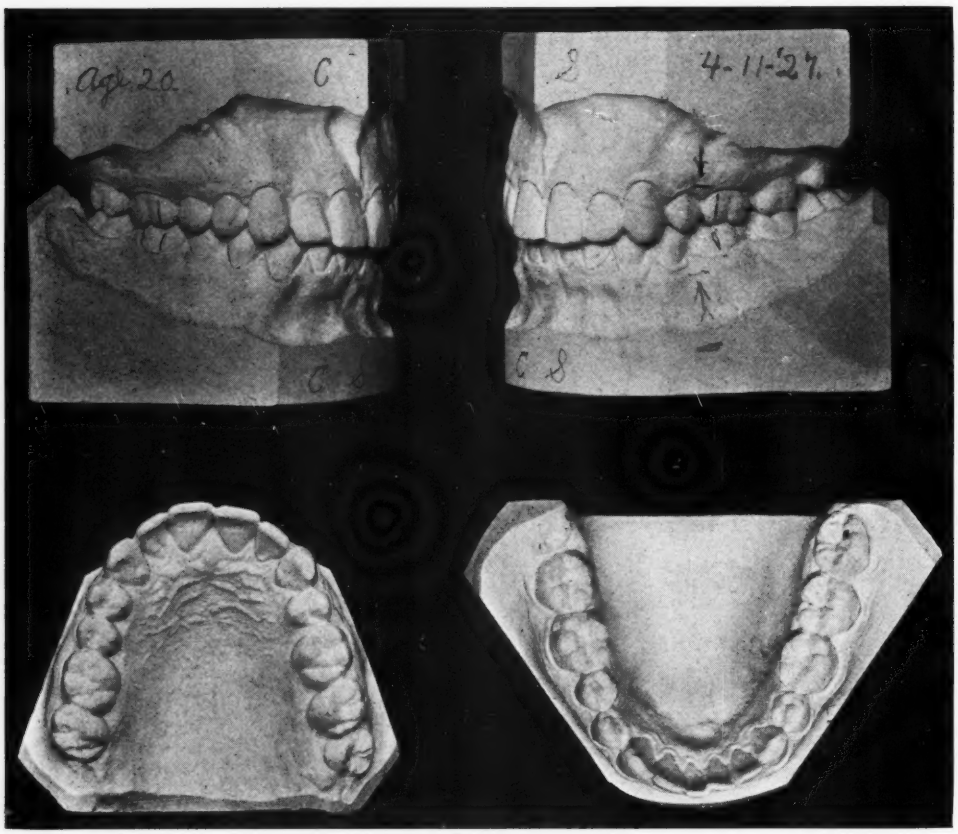


Fig. 4.

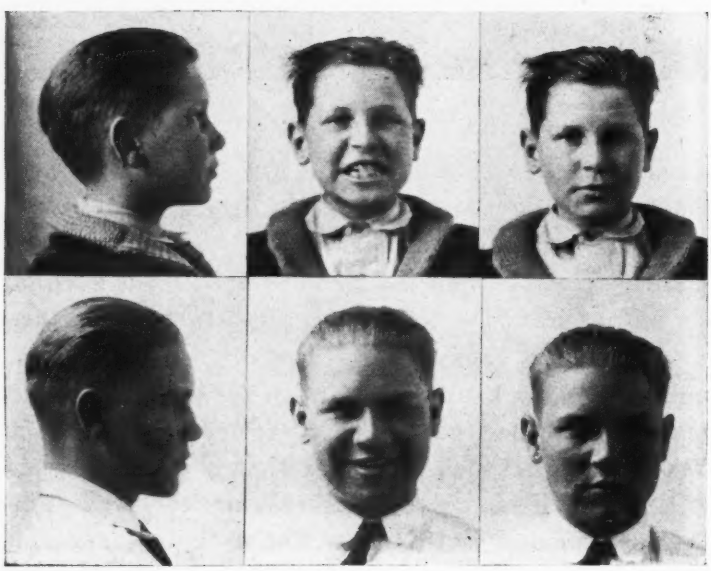


Fig. 5.

The mandibular left third molar which was impacted before treatment moved up into occlusion after the second molar had been moved forward.

Fig. 5, upper, shows the face at the beginning of treatment, lower, five years after treatment.

CASE C.—Fig. 6 shows the models of a young man, twenty years of age when treatment was started in January, 1920. This case presented many complications, in that both mandibular second premolars and the left mandibular permanent canine are absent with the right second deciduous molar in place. There is also a lingual impaction of both maxillary canines. (Note the lingual position of crown and labial position of apices of roots.) The mandibular left canine had been extracted before the case was presented, leaving the decid-

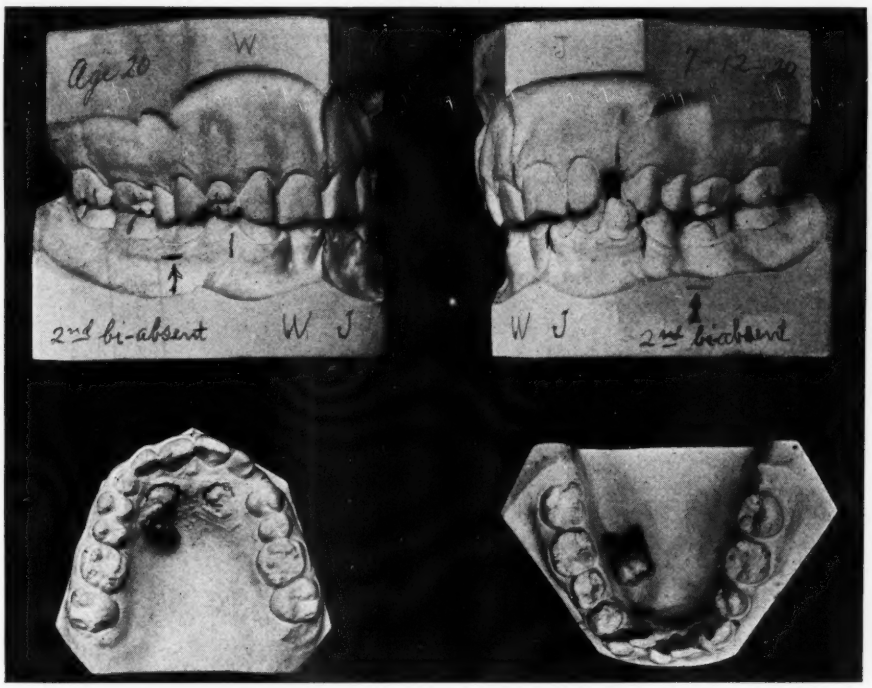


Fig. 6.

uous mandibular left canine in place. Another problem to consider was the hypoplasia of all four first molars and some of the incisors.

In this case we decided to close the spaces caused by the congenital absence of the mandibular premolars, by moving the mandibular molars forward, and to retain the mandibular left deciduous canine in position, and to open spaces for the impacted maxillary canines and move them into position.

During treatment we restored the tooth form of the maxillary and mandibular molars by means of casting occlusal surfaces to our molar anchorage bands. They have since been restored with cast gold restorations. In this case the mandibular third molars were impacted before treatment. After the second molars had been moved forward, they erupted into occlusion, as shown by models made three years after treatment, Fig. 7. Fig. 8, upper, shows face before treatment, lower, three years after treatment.

CASE D.—Fig. 9, upper, and Fig. 10, left, show models of a girl eight years of age when treatment was started, April, 1918. The others are study models made during treatment. The last models were made April 1, 1927, three years after all appliances were removed. This case presented the problem of a congenitally absent left maxillary lateral incisor. The girl is a daughter of a specialist in dental radiography and diagnosis, a man of na-

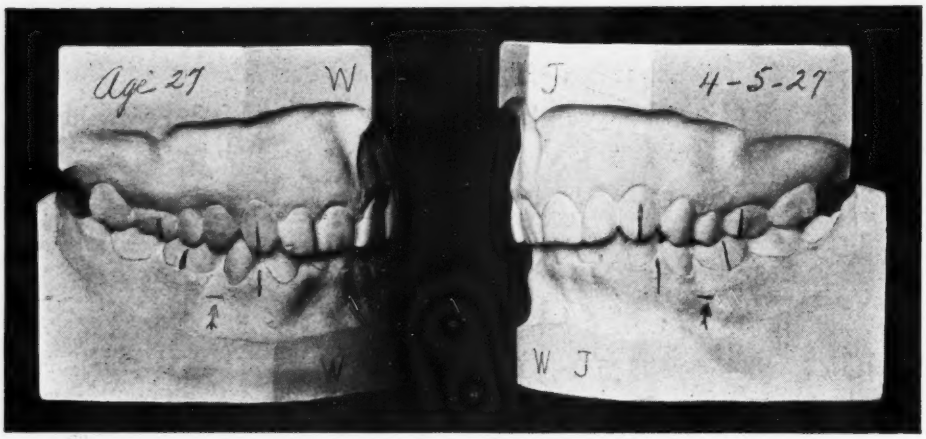


Fig. 7.

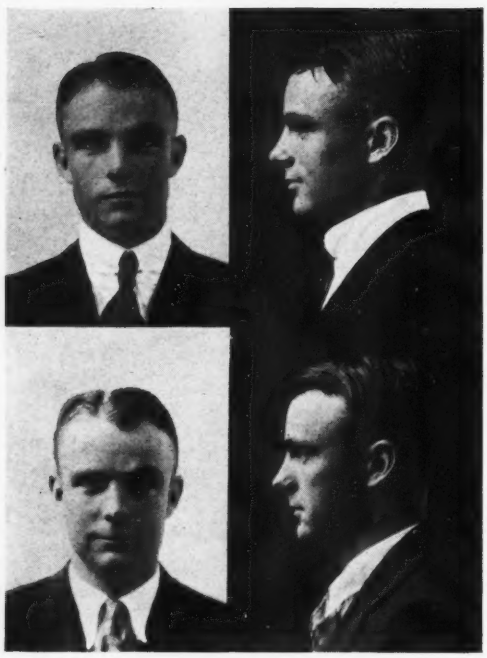


Fig. 8.

tional reputation with many years' experience. When we discussed the case with him, he advised against supplying the missing lateral by a restoration, due to the many failures of teeth used for abutments he had observed in his practice. Our treatment was outlined to close the space of the missing left maxillary incisor by moving the maxillary teeth on the left side forward.

Subsequent x-rays during treatment disclosed the progressive resorption

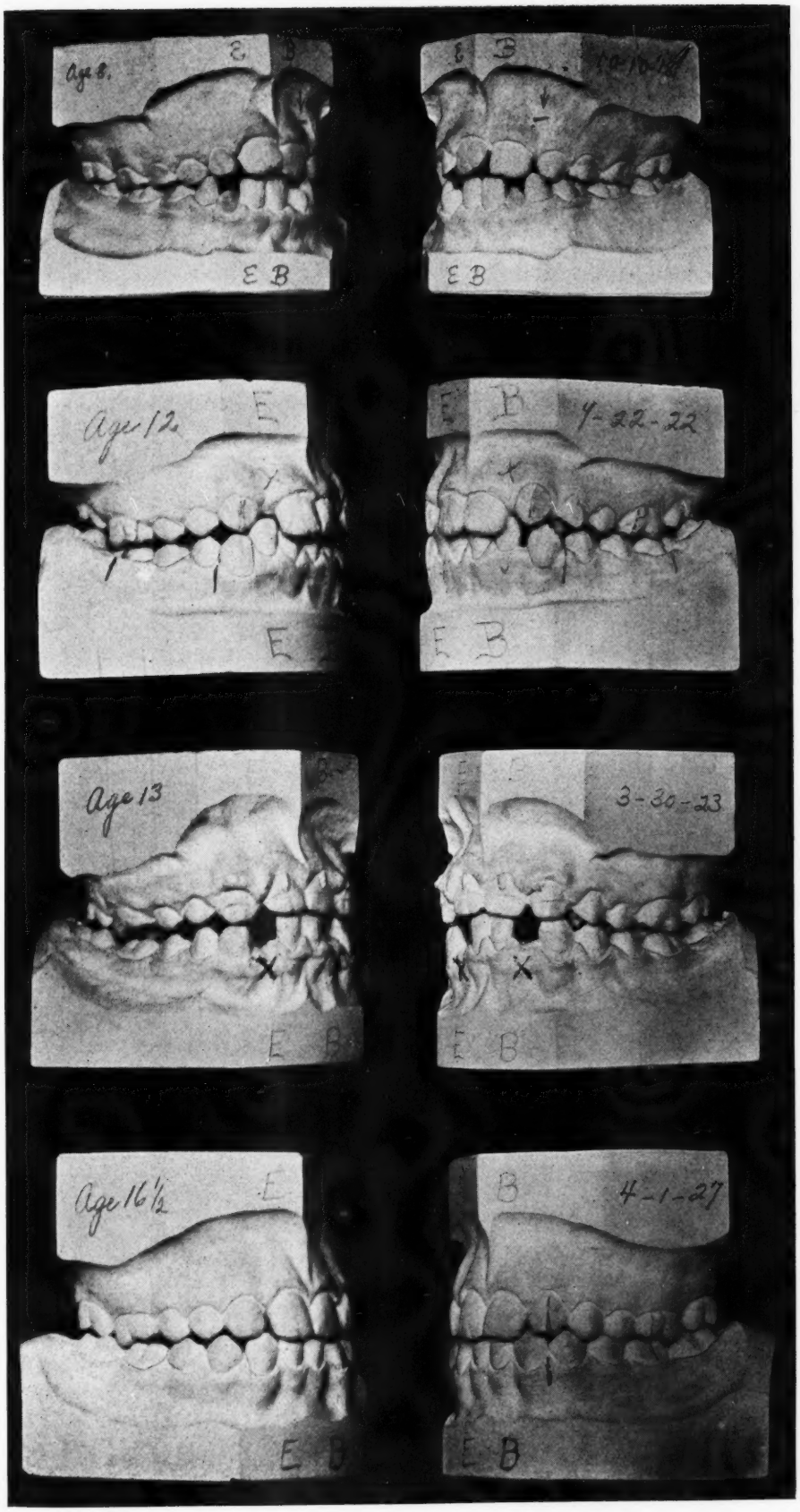

Age 8.
E B
E B
Age 12.
E
E B
4-22-22
E
E B
Age 13
3-30-23
E B
E B
Age 16½
E
B
4-1-27
E B
E B

Fig. 9.

Age 14-2
Elizabeth
Brownlie
4-2-27
Age
13
Eliz-
abeth
Brownlie
3-30-23
Elizabeth
Brownlie
9-22-22
10-10-18

Fig. 10.

Fig. 11.

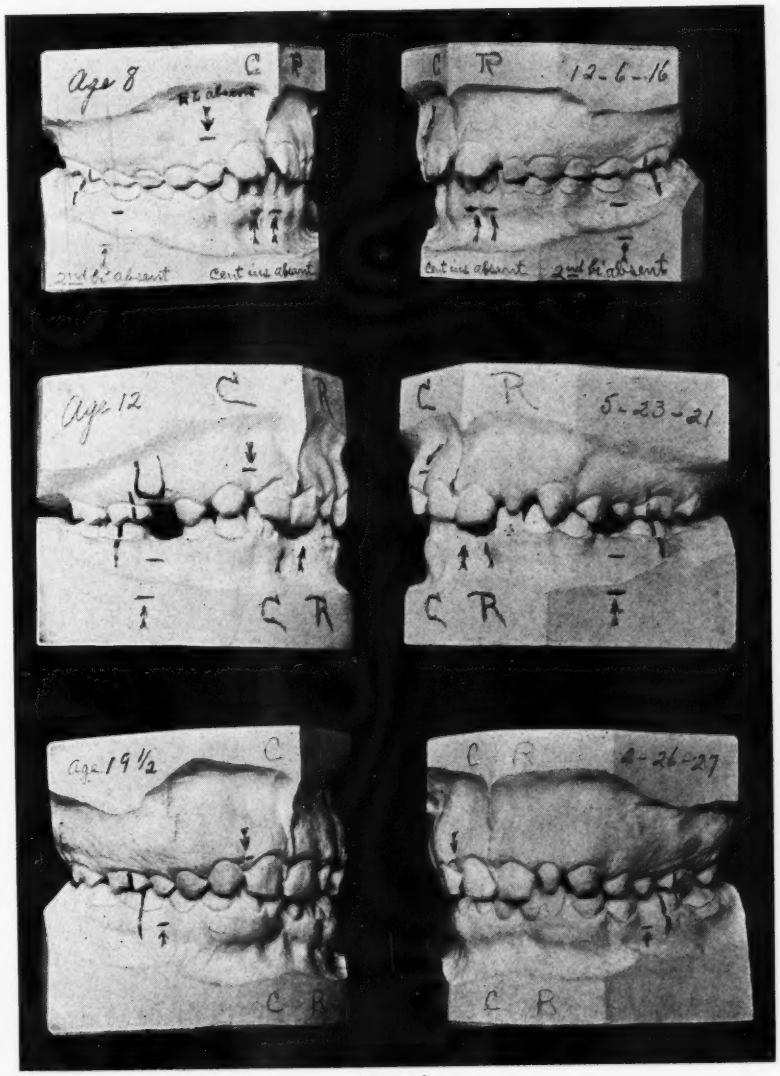

Age 8
C R
#2 absent
2nd Bi absent
Cent ins absent
C R 12-6-16
Cent ins absent
2nd Bi absent
Age 12
C R
C R
C R 5-23-21
C R
Age 19½
C
C R
C R 2-26-27
C R

Fig. 12.

of the root of the maxillary right lateral incisor, apparently due to the close proximity of the crown of the right maxillary cuspid. At this time we held a consultation with the father, deciding that as the right maxillary lateral

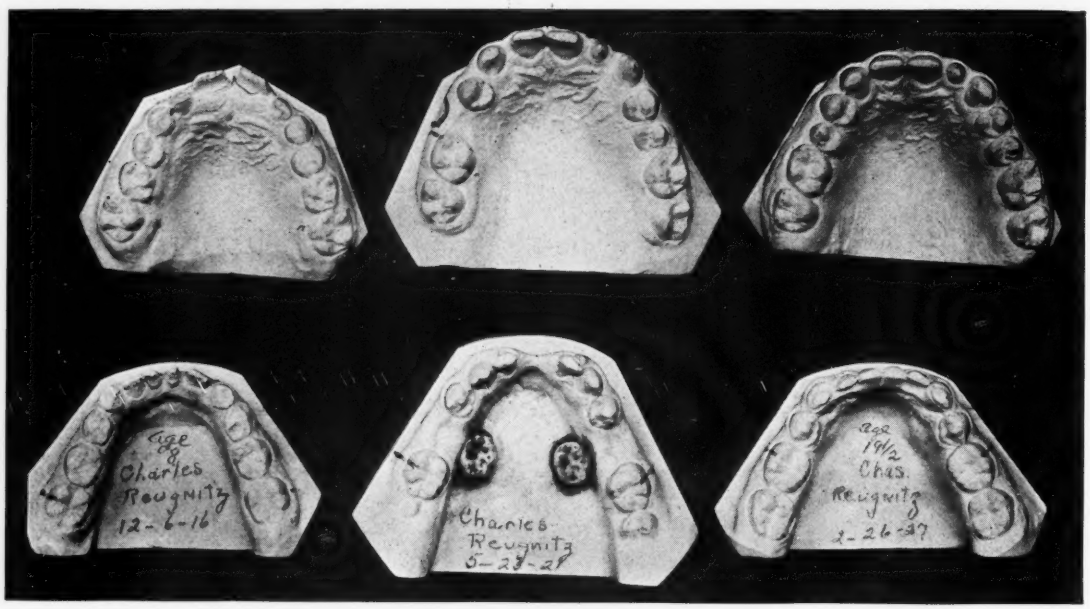


Fig. 13.

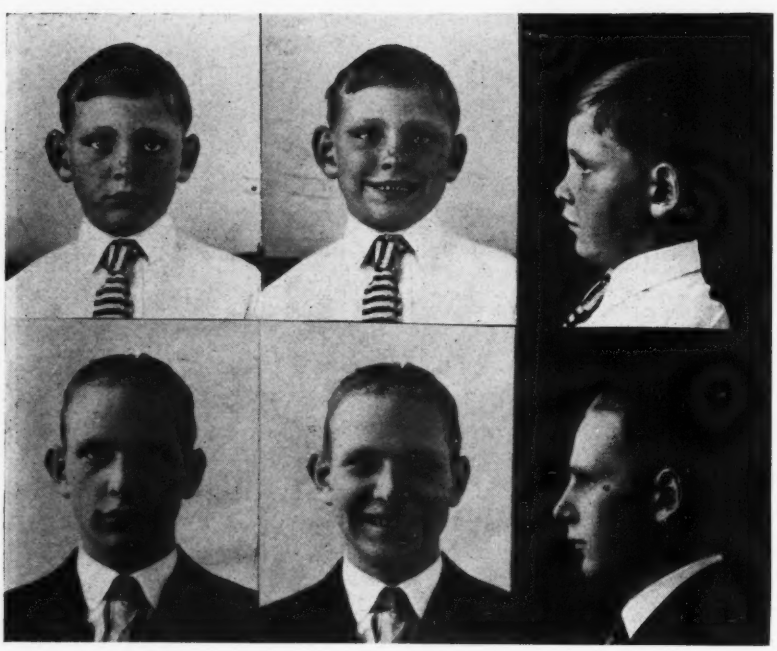


Fig. 14.

incisor crown seemed about to be exfoliated, we would, in order to escape artificial restorations and still secure normal occlusal relations of the maxillary and mandibular teeth, sacrifice the mandibular lateral incisors and move both the

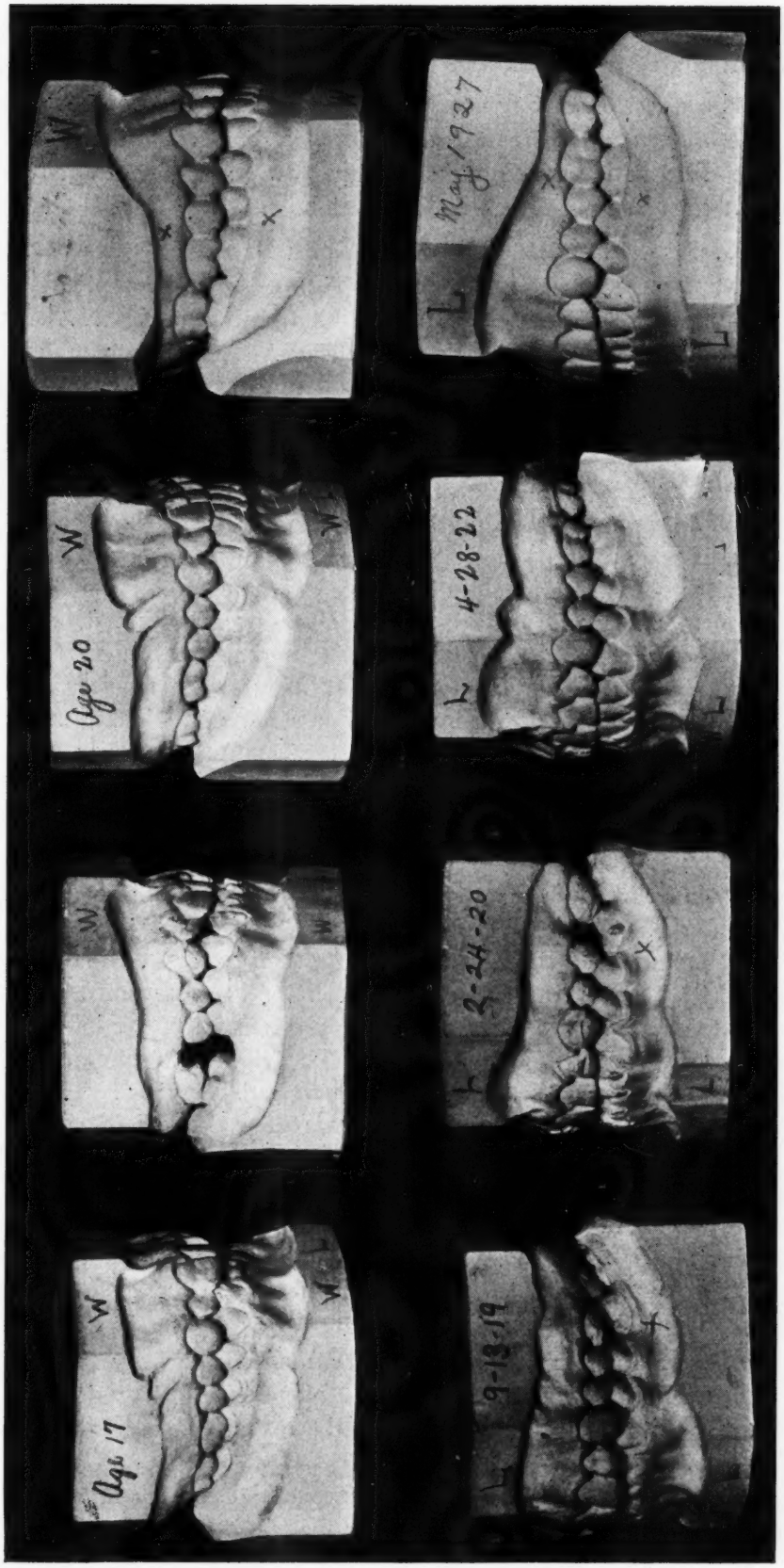


Fig. 15.

maxillary and mandibular posterior teeth forward. Fig. 11, upper, shows the face at beginning of treatment, and lower, three years after completion of case.

There is a question in our minds that the facial beauty might have been better if we opened up and retained the spaces for the maxillary lateral incisors. The third molars were impacted and now show some improvement in position, but they are not free from impaction.

CASE E.—Figs. 12 and 13 show models of a boy eight years of age when treatment was started in October, 1916. This case was complicated by the congenital absence of five teeth, the mandibular central incisors, second premolars, and the maxillary right lateral incisor. The maxillary left lateral incisor was cone shape. This case presented the problem of a patient faced with four bridges. Treatment was outlined in a manner to save three out of four of the bridges.

Space for artificial mandibular central incisors was opened and retained. The mandibular molars were moved forward to close the spaces occasioned by the missing second premolars. The maxillary posterior teeth on the right side were moved forward to close the space occasioned by the absent right lateral incisor. The mandibular central incisors were supplied, at the time, by means of porcelain facings soldered to a lingual retaining wire attached to mandibular canine bands. The left maxillary lateral incisor crown will later be restored to normal form by means of a porcelain jacket crown. Fig. 14, upper, shows the face at beginning of treatment, and lower, three years after all appliances were removed. The mandibular third molars were impacted. They have not erupted, but their positions have improved until they are almost normal.

CASE F.—Fig. 15 shows a series of models of a boy seventeen when treatment was started. This case is of special interest, because all four second molars were moved into the place of the first molars. The mandibular left first molar had been extracted some years before the patient presented for orthodontic treatment; and the mandibular left second molar had tipped forward and rotated in a lingual direction. The right mandibular first molar had a vital pulp, but practically all the crown had been lost. The maxillary first molars were pulpless, and the radiograms showed areas of rarification, so extraction of all three was decided upon. The left mandibular third molar had erupted before orthodontic treatment was started, after the second molars were moved forward, the mandibular right third molar and the maxillary third molars erupted. The models shown on the right, Fig. 15, were sent us by Dr. Carlton B. Mott, Asheville, North Carolina. These show the result five years after all appliances had been removed.

This case, with the exception of the last model, was fully reported in the INTERNATIONAL JOURNAL OF ORTHODONTIA, November, 1924, under the title of "Case Indications for the Use of Some of the More Efficient Forms of Appliances."

Our experience has taught us that the service rendered to the patient in such cases is best, even though there has been some sacrifice of facial beauty. Therefore, we consider the procedure followed the lesser of two evils.

Clinics

LINGUAL EXPANSION ARCH*

By Dr. W. J. Furie, Long Beach, Calif.

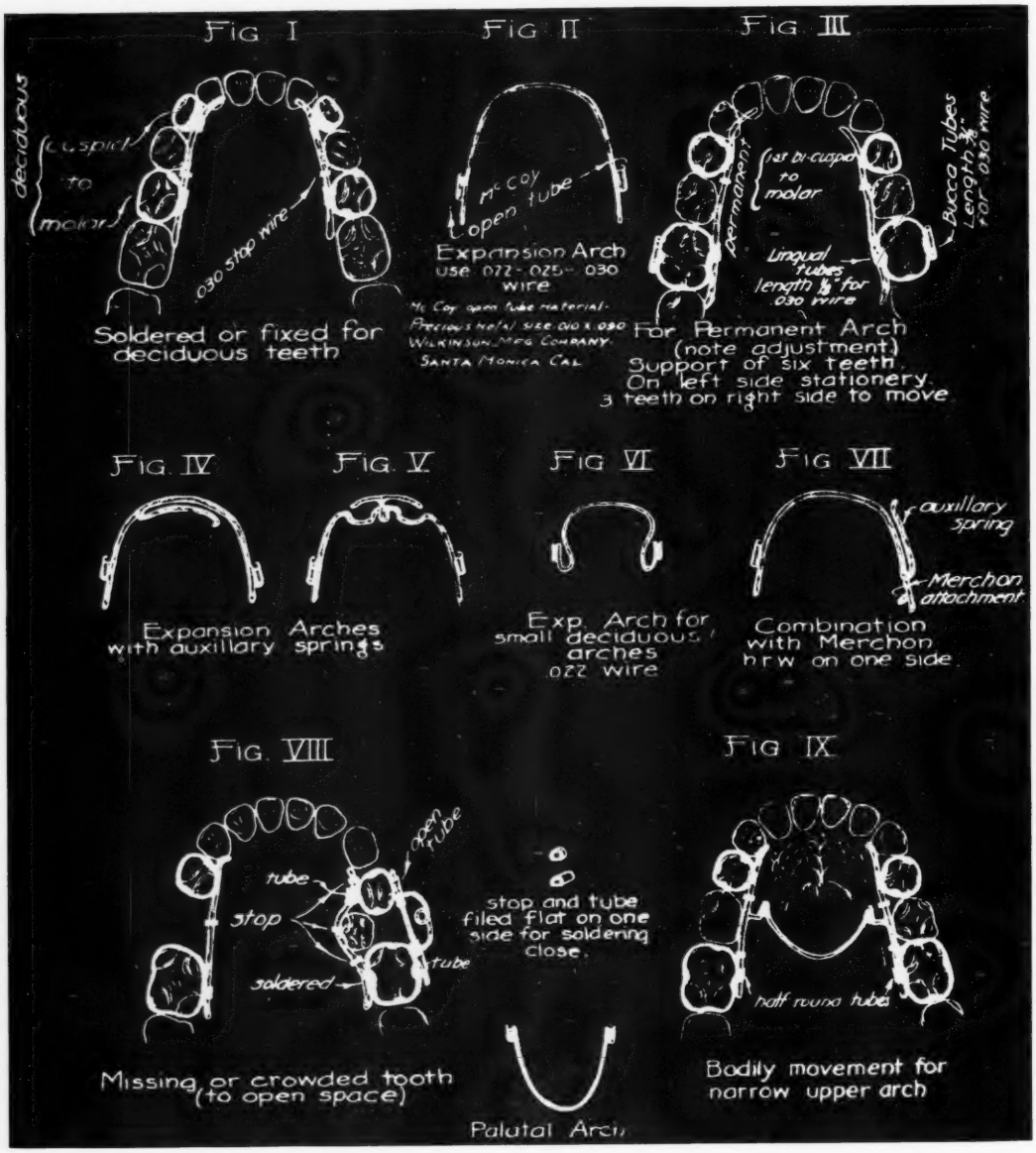
I ADMIRE and use the lingual arch, both forms, soldered and with Mershon attachments. In fact, I use them so much that occasionally I get in trouble, and the principal trouble is the tipping or loosening of anchor teeth, particularly in the lower arch. A lingual expansion arch on the maxillary teeth in my hand has not been so successful, and its use is limited to necessary means of construction, occlusion with lower teeth, etc. I further believe the lingual appliance is the nearest approach to the natural way to secure development of the dental arches as nature intended it.

The tongue has a further purpose other than that of taste and speech. It is an organ and must develop its own chamber or oral cavity. When it is unable to do this, assistance should be given, and the tongue does develop as the oral cavity develops. A child with a small tongue has a lack of development of dental arches, just as a child with a large tongue has an overdevelopment of dental arches, causing spaces between the teeth, with a decided forcing forward, and tipping of all the teeth, also note lack of superior maxillary development of a tongue-tied child. I believe further that the bodily development of the child and the size of the teeth have very little to do with the size of the tongue. I have never seen a large tongue in a mouth of crowded teeth, nor a small tongue in the mouth of overdeveloped dental arches. In underdeveloped cases then, the solution would be to develop the tongue, as the tongue no doubt is the cause of this underdeveloped condition, and not the crowded teeth, the cause of, or preventing the underdeveloped tongue. Therefore, it is reasonable to assume that the proper way to bring about this development of the arches is from the inside of the mouth, or assisting the tongue by applied mechanical stimulation to perform its function. As the child's arches are developed, making larger oral cavity, I believe in time the tongue becomes larger to accommodate this space, hence another advantage of early treatment. I find further that mild stimulation applied in this manner will not tip the teeth, but the development obtained apparenly moves the teeth in an upright position.

With this appliance the treatment from the start is such a gradual process, that is, the tension of the light wires may be so gentle and definitely controlled, that little discomfort, if any, is experienced by the child. Strong and heavy wires are not necessary to hold this appliance to position, and the

*Clinic presented before the Twenty-sixth Annual Meeting of The American Society of Orthodontists, Chicago, May 2-5, 1927.

ease of removal for adjustment, and the fact that no two teeth are splintered together, adds greatly to the comfort of the child as well as the operator. The cases I get the most pleasure out of treating with this appliance are the types, I used to say, and was taught, would correct themselves, then keep the case under observation to find that eventually a severe malocclusion would



develop, but more of the permanent teeth were now erupted, and I had something to work with and an older and better child to work on. I mean that a five- or six-year-old child with close bite, the two lower central incisors just erupting, crowded or lingual to the deciduous teeth, and the necessary space between the deciduous teeth lacking, this condition does not correct itself readily when the maxillary anterior deciduous teeth overlap the mandibular anterior teeth, approximately ⅔ the length of the crown, and in some cases even touching the gingival gum margin.

In these cases light stimulation of the mandibular arch will bring about sufficient development to open the close bite and in turn stimulate the upper deciduous teeth sufficiently to bring about a natural development of the upper arch, and the characteristic spaces between the teeth soon appear. This much of a development is positive and requires about three to eight months time.

While I am satisfied that the time and money are well spent by the patient, I only agree to do that much in the hope that further treatment may not be necessary. I notify the patient that should the permanent teeth erupt in malocclusion, due to some unfortunate reason, this preliminary treatment has served a very definite developmental purpose, and we have worked with the deciduous teeth exclusively.

This lingual expansion arch I am presenting for your approval was first used on a mandibular case where the teeth had become loosened and tipped. I could not remove appliances for an indefinite period, as the present occlusion with the maxillaries would pound back what we had already obtained, as lingual cusps of maxillary right premolars occluded on buccal surface of buccal cusps of mandibular premolars, so I supported the loosened anchor teeth (six-year molars) by banding the first premolars and taking an impression with all bands in place and making a soldering investment model. Using oxygen and gas flame, I soldered molar and premolar bands together on each side with 0.030 wire. This did support the weakened molar teeth and the wire was allowed to extend back to second molars and forward to the canine teeth as control wire (to be explained later), and at position of second premolar a small wire stop was soldered. (Fig. III.)

Now for expansion arch—a 0.025 wire formed around lingual surface of lower anterior teeth, and extending a few millimeters beyond said stop on anchor wire. At position of stop on upper surface of this wire are soldered home-made open tubes as recommended by Dr. James McCoy, size 0.91 by 0.011 Wilkinson's open tube material, the lips of these being sufficiently long to grasp wire and pass well beyond it. (Fig. II.) This arch, now, may be set to place, after giving as much tension as you need for expansion. This expansion arch cannot be kicked up with tongue, or distorted with food or candy, or even the fingers, as the soldered support wire that was allowed to extend to the cuspid and over expansion arch. Another needed feature of allowing the wire to extend on each side is that by bending the wire to second molar and canine, and lateral incisor, one side, giving support of six teeth and away from these teeth on the other side, the latter three teeth will move en masse so that either side may be moved individually or together. (Fig. III.)

The above type of appliance works beautifully with deciduous teeth by banding deciduous second molars and canines. This type expansion arch needs very little attention and requires no fine adjustments. Very little discomfort is experienced by the child and a more natural development than I have been able to get with any other type of appliance is obtained. (Fig. I.)

We learn from giving clinics, and on giving my clinic in San Francisco, I learned more about my own appliances than any man that saw it. Dr. Ketcham of Denver opened my eyes and I felt encouraged at the amount of

time he spent at my clinic, and I appreciate and have learned from his criticism and suggestions. Dr. Ketcham was not in favor of splinting the teeth together on each side, so now when using on permanent teeth I solder short tubing on molar bands, or on first premolars if the second premolar space is lacking. I also cut this tubing in very small pieces and run wire through it and solder for stop (see diagram). This stop may be placed mesially or distally, depending upon where most expansion is needed and controlled by extended wire against second molar and canine. If auxiliary springs are preferred on anterior teeth, they may be attached to expansion arch. (Figs. IV and V.)

I am now using, and believe successfully, this means of expanding posterior and correcting of crowded conditions of anterior teeth on the maxillaries also, particularly cases where only one side is collapsed, and should be brought back without disturbing the teeth on opposite side (Fig. VII), and on extremely narrow arches with their characteristic high palate. This, however, is experimental, but looks good on paper, and as far as I have gone, the results are very gratifying.

In conclusion let me say that I expect criticism, as this to date is not perfect. I am making numerous improvements and finding different uses and possibilities for them. If you believe too many wires are employed, let me say that moving the teeth en masse and the manner in which the expansion arch is held so firmly in place and the fact that every tooth has a free movement there is very little discomfort experienced, and my older patients that have been wearing other types of appliances do not mind the extra wire, even prefer it due to extra comfort.

I may be overenthusiastic for I have changed dozens of the other type for this new one, and in many cases using it on both maxillary and mandibular in the same mouth. Then I place tubes on buccal surface of molar bands and open tube on premolar band of maxillary in case a buccal arch should be needed, as for intermaxillary ligatures.

COMBINATION LIGHT LABIAL AND HIGH LABIAL ARCHES WITH VARIATIONS*

By Stanley M. Dow, D.D.S., New York City

THE following clinic has been arranged to show the practical use of double labial arch forms with modifications, which have been spoken of as "being within the range of good therapy."

I believe in the standardizing of treatment of orthodontic cases as far as possible, trying to avoid too many different appliances. Light labial wires of 0.022 are used by many men today with or without bracket bands; I favor this, with a soldered lingual appliance in all cases necessary to prevent tipping or rotation of the molars. Dr. Hawley once having said that "he could pull a tooth better and safer than he could push it" makes me think this is the best plan.

It has not been possible to show or photograph all cases and stages, but the accompanying cases will give some idea of work accomplished. The models pictured have been renumbered from 1 to 5 for convenience. Case 1, an ideal anterior arch form obtained with 4 mm. of lateral expansion in molar and premolar regions in eight months time with only four visits possible. Case 4, pretty result in one year, average lateral expansion of 6 mm. with reduction of anterior protrusion by 4 mm., complicated by impacted second premolar. Case 5, in retraction of mandible, anterior teeth maintained fine position without lingual tipping, although lacking support of premolars through late development. An explanation of the apparatus with photographs follows.

Model 1, Appliance 1. Light, high labial arch, 23 gauge arch soldered to 23 gauge round wire in bracket bands. Rigidity and stability of the arch form to maintain any desired outline diagnosed for this case, following one of the map forms or a predetermined arch shape. Improved lateral expansion without necessity of lingual appliance particularly in short bite cases, or cases lacking development in premolar region. Positive control of anterior movement without danger of distortion, advantage to the patient only one appliance to wear and the operator only one appliance to adjust. This apparatus is particularly useful when we encounter particularly hard palate or upper arch forms, abnormal tongue condition or size, and where we find any habits which preclude the use of lingual appliances.

Model 2. High labial arch, 19 gauge, with a baby ribbon arch attached, either with or without bracket bands in all distal occlusion cases. Positive bodily tooth movement, retraction, tipping, or rotation easily controlled. A high spring pressure reinforced by a heavy body wire. Ligation and movement of premolars possible without distorting or warping the arch form so as to displace the six anterior teeth.

*Clinic presented before the Twenty-sixth Annual Meeting of The American Society of Orthodontists, Chicago, May 2-5, 1927.

Model 3. Round wire appliance, 23 gauge, double anterior section rigidity of predetermined form in distal occlusion cases for retraction or pivoting from apex of tooth.

Model 4 (Dr. Porter's appliance). Labial arch wire, 19 gauge, with 23 gauge spring wire to six anterior teeth. Gentle, steady spring pressure, easy to control, comfortable to patient, delicate tooth movement producing very fine results.

Model 5, Appliance 1. Distal occlusion cases. Twenty-three gauge wire anterior double arch section. Bodily movement of teeth or retention of same maintained by two points of contact with ligatures, prevent tipping, elongating or displacement of the anterior teeth so often resulting from strong pressure or elastic force in correcting mesial occlusion cases. The so-called common rat-bite expression can be overcome with this apparatus. Light wire arch becomes strong enough to produce results in these cases.

Appliance 2. Modification of Appliance 1 with 19 gauge body wire and 23 gauge anterior section soldered to it, loop springs giving longer range, control movement, and expressions found in mesial occlusion cases.

MOLAR BAND TECHNIC*

By Alfred Paul Rogers, D.D.S., Boston, Mass.

THIS clinic is a description of the finer technic with relation to the construction and application of cemented bands.

The tooth which is to be banded must first be thoroughly cleaned. An accurate plaster impression is then taken. The amount of free gum margin is carefully ascertained. The distance the operator intends his band to go under this margin is indicated on the impression by a pencil mark both buccally and lingually. Before the impression is varnished, it is trimmed down to the point indicated by the pencil mark, and at right angles to the long axis of the tooth. The impression is then varnished with shellac. When thoroughly dry the operator secures a pencil made from modeling compound. The end of this pencil, having been made free from grooves or wrinkles, is then warmed to a uniform depth, leaving in the center a hard core. On its way from the flame to the impression it is quickly immersed in a receptacle of vaseline, the point only being covered. It is immediately plunged into the tooth impression, taking care that the pencil is held in the exact direction of the long axis of the tooth. When sufficiently hard the compound die is removed from the impression, when the buccal and lingual planes, each standing at right angles with the axis of the tooth, will be seen, indicating the point at which the carving of the compound respresenting the soft tissue shall terminate. The operator then proceeds to carve away from the tooth surface the compound representing the gingival tissue. This carving must be so carefully done that the enamel surfaces represented by the compound model are not changed or marred. Mesially and distally the base lines are allowed to curve occlusally, being continuous with the buccal and lingual planes. This surface, which is always carved at right angles with the long axis, is termed the "seat," and, when the carving is complete, determines the length and form of the gingival surface of the band. Upon completion of this carving the compound model receives a thin coat of varnish, and when sufficiently dry is inserted into a bed of plaster to which a small portion of sump has been added. When this investment is sufficiently hard, the compound is carefully softened in hot water and very carefully removed from the investment, which is then allowed to dry, and is later filled with Melotte's and Sharp's metals. This metal die is then removed from the investment. When this stage is reached the operator may proceed by whatever method he wishes to employ in the construction of the bands—either swaged or burnished.

*Clinic presented before the Twenty-sixth Annual Meeting of The American Society of Orthodontists, Chicago, May 2-5, 1927.

REMOVABLE ANTERIOR SECTION FOR HAWLEY RETAINERS*

By Augustus B. Holt, D.D.S., New York

IN CASES where a removable retainer is desired, I have found nothing more satisfactory than the Hawley retaining plate. However, in many instances, it is noted that the gold semicircular wire will break where it crosses the occlusal line, or close enough to the rubber plate to make repair difficult.

To overcome this, I am suggesting a method for making the anterior gold work removable, either for repair or remodeling.

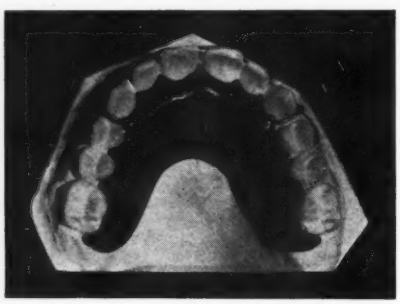


Fig. 1.

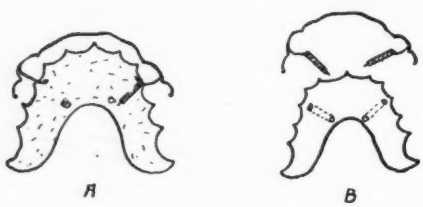


Fig. 2.

Follow Dr. Hawley's technic up to the point of waxing in the finished gold work, then proceed as follows: make a right angle bend in the semicircular parallel with the palatal gingival line of the canine. Cut 10 millimeter sections from 14 gauge half-round tubing, also pin to fit it. Solder a cleat or notch the tubing to prevent it drawing out of the vulcanite. The half-round pin is now soldered to the semicircular at the angle formed at the gingival border of the canine, and is fitted, flat surface down, to the model as smoothly as possible. To the free tip of this pin is soldered a 4 millimeter section of 20 gauge soft gold round wire to be used as a lock. The tube is now fitted over the pin, the soft gold tip is bent at right angles to lock the tube in position. The gold work may now be tempered and the usual procedure of waxing up the case completed. At this stage, it is best to carve the wax, freeing both ends of the tube slightly, forming a shallow

*Clinic presented before the Twenty-sixth Annual Meeting of The American Society of Orthodontists, Chicago, May 2-5, 1927.

groove for the soft gold lock pin. This will prevent the vulcanite entering the tube, and provide space for manipulation of the lock. The case is now packed, vulcanized and polished as usual. By straightening the lock wires, the pins and anterior gold work may be removed from the vulcanite.

Fig. 1 shows the completed case ready for insertion in mouth.

Fig. 2 (*A*) shows one side removed from half-round tube. The opposite side is in place with the soft gold wire bent over at the end of the tube to hold it in place. (A little compound may be used to fill in this space if desired.)

Fig. 2 (*B*) shows appliance with anterior gold section removed for repairing. It also shows the position of the 10 mm. half-round tubes in the vulcanite.

American Dental Assistants Association

The fourth Annual Meeting of the American Dental Assistants Association will be held in Minneapolis, Minn., August 21, 22 and 23, 1928, at the Leamington Hotel.

Ruth F. Rogers, Secretary,
Suite 1760, 16 N. Wabash Avenue,
Chicago, Ill.

Montana State Board of Dental Examiners

The next meeting of the Montana State Board of Dental Examiners will be held July 9-13, 1928, at Helena. For further information, address

Dr. T. P. Regan, Secretary,
Helena, Montana.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

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CONSTRUCTION TECHNIC FOR AN ORTHOPEDIC HEADCAP*

By Clyde W. Scogin, D.D.S., Captain, Dental Corps, U. S. Army

THE management of fragments in fractures is, basically, a mechanical problem. It is necessary to supply sufficient force to move and maintain the fragments in their proper relationship by antagonizing muscle action with some mechanical means. To apply force it is necessary to have a resistance equal to or greater than the applied force from which to derive that power. This resistance is called anchorage. Given a properly located and sufficient anchorage, the force application is a relatively simple problem.

In general, anchorage for reduction and retention of fragments in fracture of the jaws may be divided into three types:

First. Intramaxillary—wherein the teeth in the fractured jaw *only* are utilized for anchorage purposes.

Second. Intermaxillary—in which the teeth in the opposing jaw are utilized for anchorage.

Third. Extramaxillary—that type wherein definite anchorage must be obtained from some point distant to the oral cavity.

Extramaxillary anchorage is in turn divided into several types dependent on the area utilized:

a. *Cranial.*
b. Facial.
c. Occipital.
d. Frontal.
e. Cervical.

Cranial extramaxillary anchorage in the treatment of maxillo-facial fractures has been used for many years. There has been a gradual evolution in the method of construction of appliances utilizing this type of anchorage,

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From the Department of Oral Surgery, Army Dental School, Wash., D. C.

beginning with simple bandages and ranging through all types of headgear, such as: caps, mesh nets, webbing, straps, adhesive tape, vulcanite, gutta percha, celluloid, plaster of Paris and combinations of these materials.

At the present time, there does not appear to be any standardization of the methods or appliances used. It rather is left for the individual operator to exercise his own ingenuity in the management of the case at hand. Since cases requiring cranial anchorage are not routine, the operator does not usually construct a sufficient number to evolve an entirely satisfactory technic. It is with this in mind that a step-by-step technic for the construction of a cranial anchorage is given.

Fig. 1.—Showing application of stockinette. Proper length and position. Tape tied with ends pushed through small hole in stockinette.

This type of orthopedic headcap has proved, over a series of cases, to be entirely satisfactory and to fulfill the requirements of a positive cranial anchorage.

I. Indications for Use:

To supply convenient and positive cranial anchorage in cases of:

1. Fractures of maxillae.
2. Fractures of maxillae and mandible.
3. Fractures of mandible in edentulous cases.
4. Anchorage for rhinoplastic scaffolding.
5. Anchorage for retention of fragments in fractures of malar or nasal bones, or fractures of the zygomatic arch.
6. Other cases wherein a positive, comfortable and easily constructed extraoral anchorage from the cranium is desired.

II. Materials Necessary for Construction:

1. *Stockinette:* (3 in. x 2 feet). Three inch stockinette is six inches in circumference and capable of considerable stretching. If not available, any substitute may be used such as a leg from a pair of balbriggan drawers or a heavy white stocking.

2. *Cord:* 1 foot—heavy twine or tape.

3. *Adhesive Tape:* 1 in. wide.

4. *Orthopedic Felt:* 4 (or more) strips—1½ in. x 6 in. If not available, use strips of heavy cotton batting or several layers of nutria felt (old felt hats).

5. *Gauze Bandage:* 2½ inches x 20 feet. The ordinary gauze bandage is put up in 10 foot rolls, thus two rolls are necessary. Prepare by incorporating a good grade of dry model plaster. Unroll, dust on plaster and progressively reroll bandage.

Fig. 2.—Showing method of splitting felt to desired thickness and thinning ends to make less bulk at border of headcap.

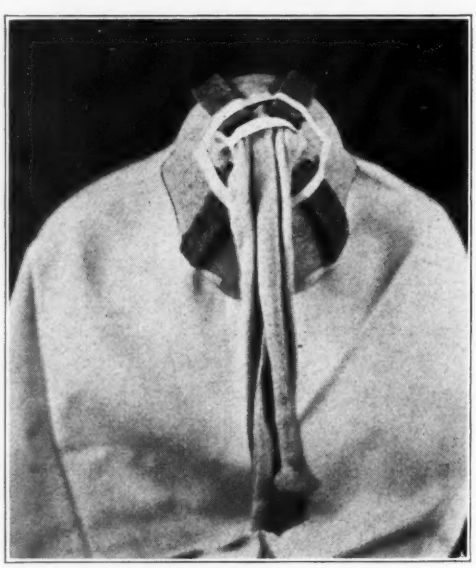

Fig. 3.—Felt strips fixed in position with adhesive tape. Coronal view.

6. *Plaster of Paris:* (good quality model plaster), large plaster bowl and heavy spatula.

7. *Traction Appliances:* leather straps and buckles, hooks, loops, webbing, etc., as indicated.

8. *Scissors:* bandage scissors for felt, small scissors for other materials.

9. *Sandarac Varnish and Small Brush.*

III. Outline of Head Areas to Be Utilized:

The direction of stress must necessarily determine the anchorage area. In general, the finished margins should extend:

1. *Occipital Region:* Well over the external occipital protuberance toward the base of the skull.

2. *Mastoid Region:* As close as possible to the ears but not encroaching on them.
3. *Temporal Region:* to about the zygomatic arch. Definitely below parietal eminences.
4. *Frontal Region:* Care must be exercised in freeing forehead to about one inch above eyebrow line.

IV. Construction Steps:

1. Seat patient in *straight-backed chair* without head rest. Have sufficient space so that operator may pass entirely around patient.

2. Drape patient well with sheet and towels to protect clothing from plaster.

Fig. 4.—Stockinette turned down. Felt is now between layers of stockinette. Outer layer cut shorter than inner layer.

Fig. 5.—Obtaining approximate basal outline and adapting first layer of plaster bandage.

3. Clip hair on men if the case is to require lengthy fixation (two or more months)—otherwise not considered necessary. Have women braid hair and arrange in loose coils on top of head.

4. Apply one end of stockinette over head to a point two inches below previously determined border outline of finished headcap.

5. Tie cord or tape loosely around stockinette at top of head so that the loop will be about two inches in diameter. (Fig. 1.)

6. Cut small slit in stockinette and push tied ends of cord through to inside. This is done so that stockinette may be tightened during later treatment if necessary.

7. Cut and adjust felt strips, one (or more) in each quadrant, tape into place on stockinette. (Figs. 2 and 3.)

8. Pull free end of stockinette down over head and trim just short of the length of the first layer. Felt strips are now between layers of stockinette. There is a small opening at top of head in which the ends of the cord are found. (Fig. 4.)

Fig. 6.—Using sponge to smooth plaster bandage.

Fig. 7.—Applying a thin coating of plaster wash over first bandage layer.

Fig. 8.—Turning up stockinette over plaster and bandage to form a smooth roll at proper outline.

9. Apply first plaster bandage: Wet bandage in lukewarm water (hand basin held conveniently by assistant), and apply as a head bandage; keep bandage wet, and smooth into place with wet hands and a piece of sponge being certain to obtain desired outline form. (Figs. 5 and 6.)

10. Apply plaster wash over this layer, smoothing well with wet hands. (Fig. 7.)

11. Turn up both ends of stockinette to form the lower border of cap, plastering the stockinette into plaster wash. (Fig. 8.)

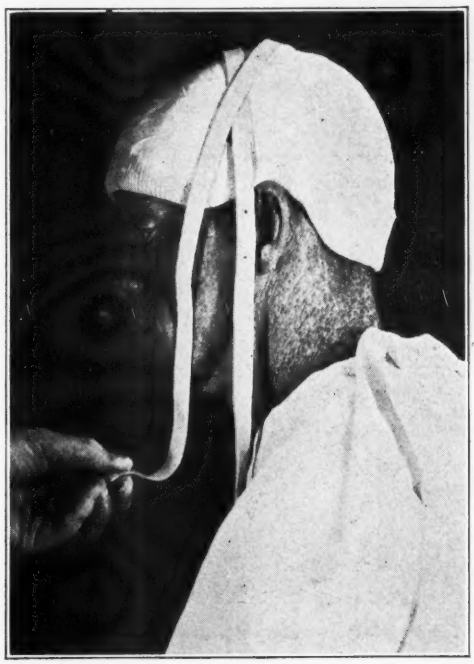

Fig. 9.—Inserting anchorage appliances: straps, webbing, loops, hooks, etc., as required. Leather straps used in this case.

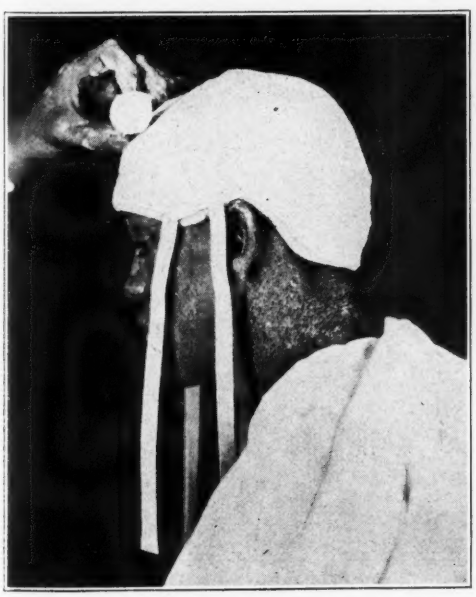

Fig. 10.—Applying second wet plaster bandage.

Fig. 11.—Application of second plaster wash and giving final smoothing.

12. Insert traction appliances as indicated for case, i.e., straps, hooks, loops, anchorage for rhinoplastic scaffolding, etc. These must be so placed as to deliver the correct directional force for the individual case. (Fig. 9.)

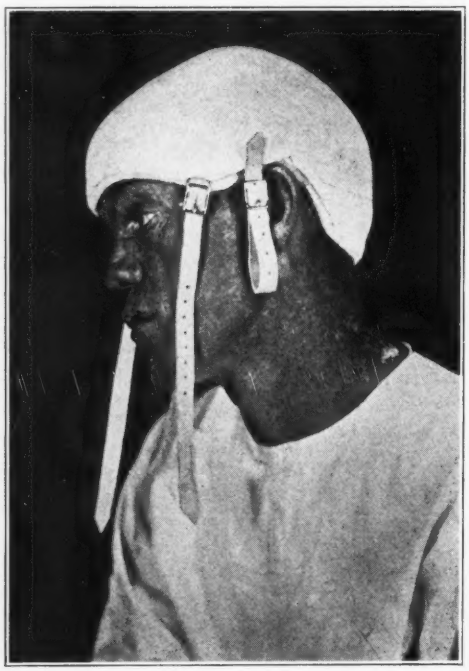

Fig. 12.—A method of inserting buckles using single straps for Kingsley arms.

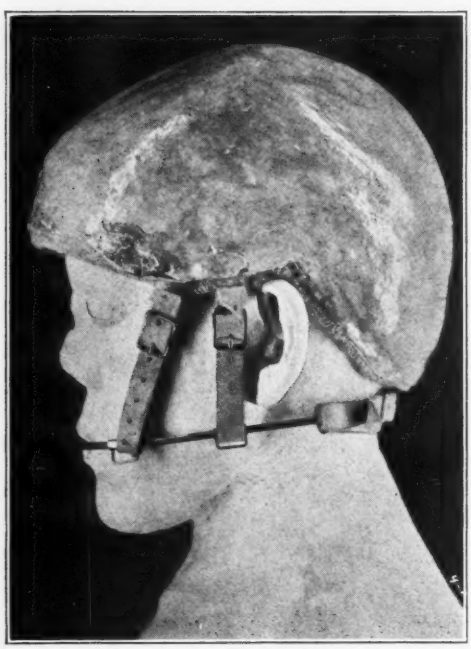

Fig. 13.—Finished headcap in position. Used with Kingsley arms and cast jacket maxillary splint. (Fracture of maxillae.)

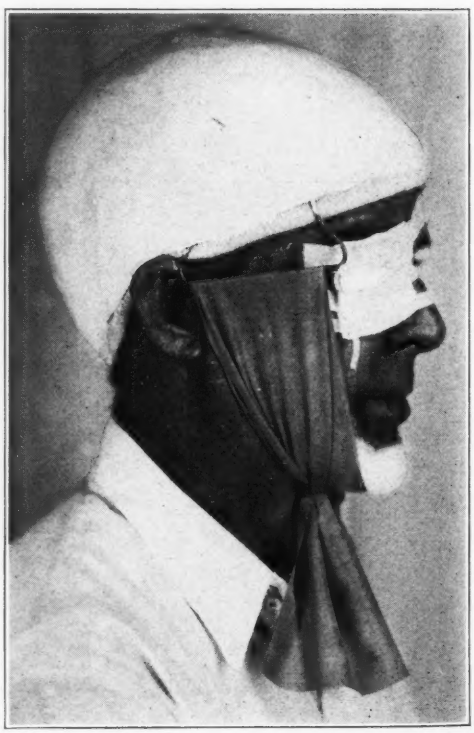

Fig. 14.—Orthopedic headcap and rubber dam used in retention of edentulous fracture cases. (Fracture of mandible.)

13. Apply second plaster bandage in same manner as before, *except* that the lower one-half inch of stockinette is left exposed, to produce a smooth, rounded border that will not cause irritation or crack during extended usage. (Fig. 10.)

14. Apply second plaster wash—smooth well with wet hands. (Fig. 11.)

15. Allow to dry four hours (on head, do not remove) then varnish with sandarac or any similar material to facilitate future cleaning. (Fig. 12.) (Figs. 13, 14, 15 and 16 show a few of the applications for this type of anchorage.)

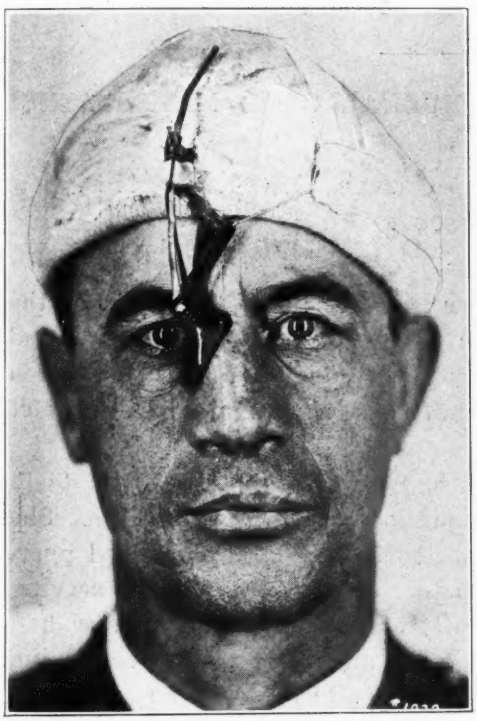

Fig. 15.—Utilization of cranial anchorage from a headcap for rhinoplasty. (Traumatic disarticulation of nasal bones.)

Fig. 16.—Orthopedic headcap with steel frontal bar for future rhinoplastic scaffolding, and rigid metal bars to Kingsley arms for directional traction. (Multiple, greatly comminuted fracture of maxillae.)

V. Remarks:

1. Easily and rapidly constructed. Construction time is approximately thirty minutes for average case. Traction can be applied immediately after completion.

2. Headcap is comparatively light—average weight is one and one-quarter pounds.

3. Construction is laminated so that maximum strength and rigidity is obtained with minimum weight.

4. Patient can sleep comfortably and no displacement of headcap or appliances occurs. Lateral displacement cannot occur because advantage has been taken of the parietal eminences.

5. Traction appliances are placed between two layers of bandages and plaster, therefore, will not pull out but are held rigidly in proper position.

6. Use of doubled stockinette and felt strips allows some air to circulate under cap and patients are not uncomfortable even in summer heat. (Holes may be cut in coronal portion for ventilation if desired but this is deemed unnecessary).

7. It is noninflammable. This is a decided advantage over celluloid construction.

8. Does not produce frontal headaches and other symptoms sometimes produced by cranial anchorage since the stress is taken up by felt strips which are in absolute contact with the head in all quadrants.

9. Materials necessary are always available and are inexpensive.

SARCOMA OF THE OVARY, WITH UNUSUAL ORAL METASTASES*

By James Barrett Brown, M.D., and Charles D. O'Keefe, M.D.
St. Louis, Missouri

A GIRL of sixteen was referred to the service of Dr. V. P. Blair, of the Department of Surgery, Washington University Medical School, and Barnes Hospital, of St. Louis, Mo., because of loose, painful teeth and swollen gums. She was unable to bite and could take only very limited amounts of anything by mouth.

About six weeks previously, she had had pain in all her lower teeth which spread to the uppers; the teeth became loose and the gums sore. She had had many kinds of treatment, the condition having been diagnosed pyorrhea, and seven teeth were extracted just before she was seen on this service. She had become very weak and mentally dejected by the time we saw her.

The upper and lower molars were missing and most of the remaining teeth were loose. The sockets in the four molar regions showed an exuberant mass of dirty red granulations 2 cm. across. In some areas the mucous membrane appeared to be growing over the granular mass. The breath was foul and the patient was weak, toxic and in mild acidosis. (Fig. 1.)

X-ray showed some bone destruction in the lower molar region and of the peridental membrane throughout both jaws. (Fig. 2.) The patient was probably below normal mentally, large for her age, was almost blind, and had coloboma iridis and epicanthus of both eyes. (A brother had a coloboma in one eye.) The forehead was low; speech was of muffled, lisping type.

There was nothing in the examination on which to make an accurate diagnosis. Some sort of cryptic, low-grade infection of an unrecognized organism was suspected. She had been in a state school for the blind and the adequacy of her diet was questioned, but found to have been sufficient. In fact, she had had an excess of orange juice, so that there was no likely possibility of scurvy.

Biopsy.—One loose tooth was extracted and cultures made. These showed almost pure diphtheroid growths and the smears showed a few staphylococci,

*Reprinted from Annals of Surgery, March, 1928, lxxxvii, No. 3, p. 467.

Vincent's organisms and some ameba. The bacteriology gave no special leads. Microscopic examination of the gum tissue showed profuse round-cell infiltration with no special arrangement except for an apparent infrequent attempt at acinar formation. (Fig. 3-*A* and *B*.) Because of the occurrence of the masses in four different areas at the same time, of the infection present and the x-ray evidence of bone involvement, definite views of the occurrence of a tumor were not formulated at first and treatment was guided along lines of local and general supportive measures.

The Wassermann was negative, urine negative, white blood count 6000 with 36 per cent lymphocytes, red blood count 4,700,000, hemoglobin 70.

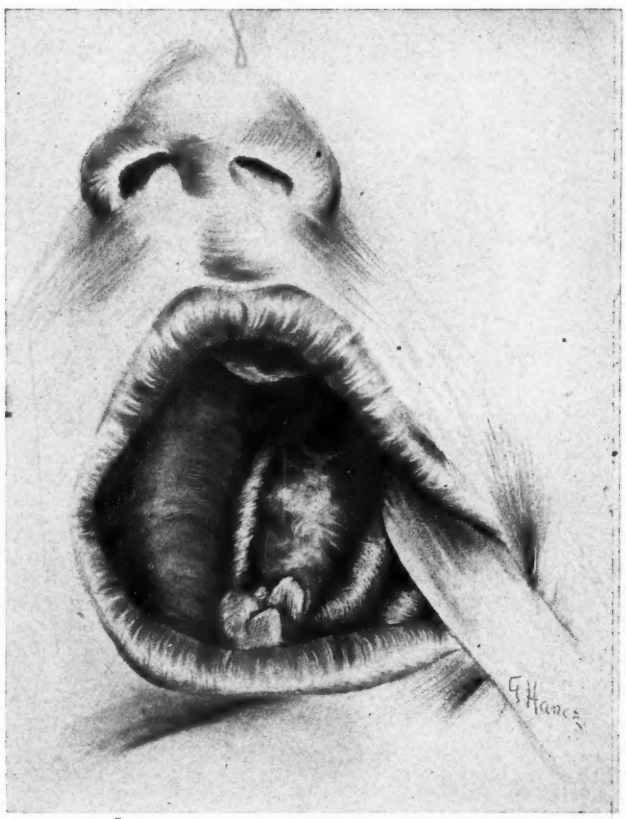

Fig. 1.—Shows the large granulomatous mass found in all four molar regions.

Treatment at first was essentially to stop infection in the mouth and to keep up the patient's resistance, and many empiric things were tried. Transfusions, full diet (antiscorbutic) with vitamines, milk injections, ultraviolet radiation, emetin intravenously, constituted the general treatment; and locally, good cleansing care was insisted upon with the use of potassium chlorate, methylene blue and salvarsan. In a week there was much improvement in the incidental infection, the discharge, odor, and pain lessening and the teeth tightening up; but the enlargements persisted. In one molar region, the epithelium closed over the mass.

X-ray therapy was then used on the gums, and two days later the growths had almost disappeared, and on the sixth day there was practically no evi-

Fig. 2.—Shows absorption of the dental periosteum and of the bone in one of the molar regions.

dence of any tumor formation. There was a rather severe general reaction to the x-ray treatment with a good deal of distention coming on just after it which was thought due to the effect of the rapid absorption of the tumors.

The patient had been having pain in both flanks and at this time it settled in the right one and became very severe. An x-ray of the pelvis showed a marked deformity with sacralization of the fifth lumbar vertebra on both

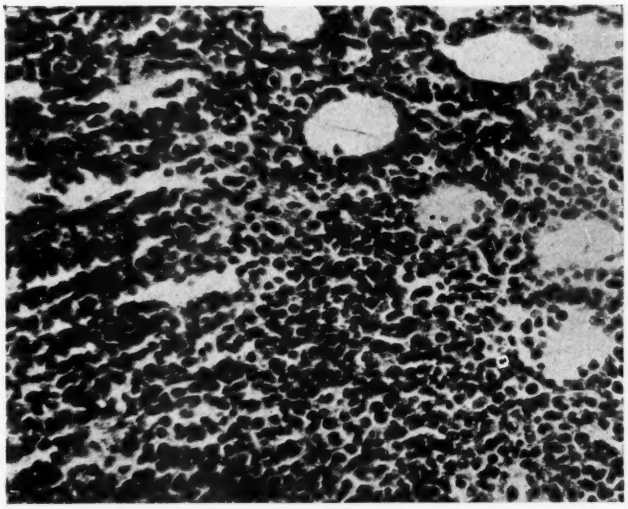

Fig. 3-*A*.—From the gum tumors. Show profuse large round-celled infiltration with one area showing something like acini. The cells are of different sizes and a few mitoses are seen.

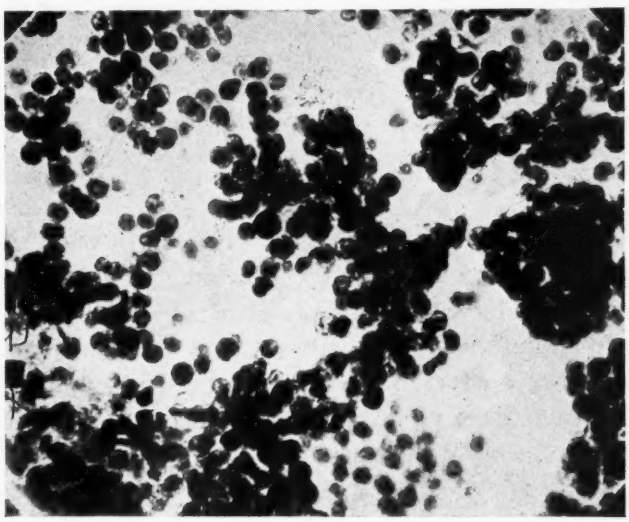

Fig. 3-*B*.—See legend under Fig. 3-*A*.

sides, most marked on the right, with possible joint formation with the ilium. There was marked distortion of the whole pelvis and both ilia. (Fig. 4.)

At the time of the examination for the pain in the flank, a rectal examination was made and a tumor mass found anteriorly. Its nature and limits were not made out, however, because of discomfort to the patient and be-

cause the pelvic deformity seemed adequate to cause the pain. The patient was put on a fracture board and in twenty-four hours the pain was gone.

At about this time, lumps were noticed in both breasts approximately 2 cm. in diameter. The abdominal distention persisted and warranted a more thorough pelvic examination.

Examination by Doctor O'Keefe showed the pelvis and lower abdominal cavity filled with a mass extending to two fingers below the umbilicus on the right and well into the culdesac on the left. The mass could not be outlined nor separated from the uterus. The mass was firm but not hard. There was free fluid in the abdominal cavity. The probability of malignancy was considered. Two days later this mass extended above the level of the umbilicus. This rapid growth could not be accounted for by physical examination. Be-

Fig. 4.—Besides the bone deformity, there is shown a partial absence of intestinal gas in the pelvis. This is due to the tumors filling the pelvis.

cause of this growth and distention without relief from enemata, it was decided to do an exploratory laparotomy at once.

On opening the abdomen, a large amount of free blood-tinged fluid was found in the abdominal cavity. Large ovarian tumors were found on both sides. The tumors were covered by the omentum which was heaped up near the top of the right tumor, which was ruptured at this point. Undoubtedly this rupture took place at the examination two days before and the omentum was attempting to cover up and wall off this raw surface, which accounted for the apparent rapid growth during this period. The tumors were pale in color and very friable.

The tumors were removed together with a piece of the omentum and the abdomen closed. A small nodule was removed from the left breast. Frozen sections from both ovarian tumors and the breast nodule showed lymphosarcoma. (Figs. 5-*A* and *B*.)

Because of the rapid absorption of the gum tumor and the type of cell

growth found, general deep x-ray therapy was recommended but refused. The patient died on the thirteenth postoperative day.

At the Barnes and the St. Louis Children's Hospitals, in over 69,000 admissions, there have been only four cases of sarcoma of the ovary. The ages were six, seventeen, twenty-two and thirty-one. The percentage of occurrences of sarcoma of the ovary in Barnes Hospital and Children's Hospital

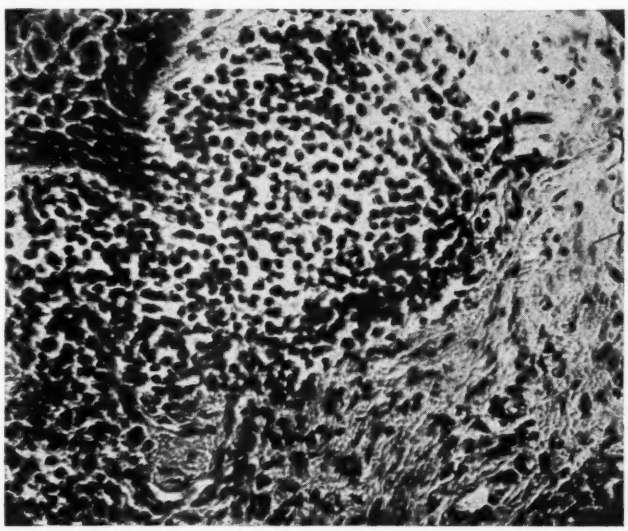

Fig. 5.-*A*.—Sections from the pelvic and breast tumors. Show practically the same picture as the gum sections, with no apparent attempt at polarization.

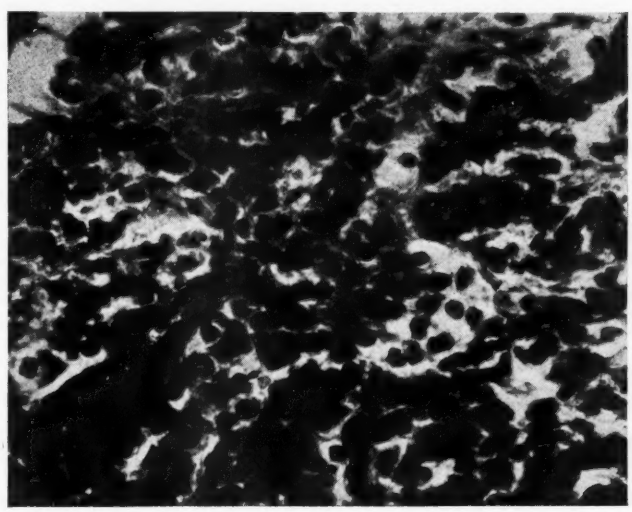

Fig. 5-*B*.—See legend under Fig. 5-*A*.

was not estimated, although it is reported in the literature as occurring in from 2 to 5 per cent of all ovarian growths.

Sarcoma of the ovary may occur at any age from fetal life on, but occurs much more frequently between the ages of twenty-one and thirty. It occurs much oftener than carcinoma in young girls.

The fact that the patient reported for treatment for the localized involvement of the gums adds especial interest. The primary focus was un-

doubtedly the ovaries. The simultaneous metastasis to several sites in the mouth at one time, without previous clinical signs from the primary focus, has not been seen by us, with one possible exception, nor can we find any reported cases. It may be possible that this already generalizing growth found lodgement in the gums on account of the trauma of the extraction or of the infection present.

REFERENCES

[1]Blair, V. P.: Surgery and Diseases of the Mouth and Jaw.
[2]Blair, V. P., and Padgett, E. C.: Surgical Diagnosis, Graham, E. A. (to be published).
[3]Crossen, H. S.: Diseases of Women.
[4]Frank, R. T.: Gynecological and Obstetrical Monographs, 1922.
[5]Moore, S.: Radiology, May, 1924.
[6]Moorehead and Dewey: Pathology of the Mouth.
[7]Scheffey, L. C.: Sarcoma of Ovary in Children and Young Girls, Am. Jour. of Obst. and Gynec., April, 1925, ix, 490-502.

CYSTS OF THE ORAL CAVITY

By Albert J. Kay, D.D.S., Kansas City, Missouri

THE subject of cysts of the oral cavity is one of vital interest and has been given much consideration and study by recognized specialists in the field of oral surgery.

A cyst is a circumscribed cavity having a well-defined, organized lining membrane containing a fluid or semi-fluid substance.

This substance may be sterile or infected.

The most common types met with in the oral cavity are the radicular or root cysts, the follicular or dentigerous cysts and the ranula, which is a form of retention cyst.

The rarest types are the mucoid and multiocular cysts.

Radicular cysts are the result of devitalized or pulpless, infected teeth. When a nidus of infection is established in a tooth apices, reaction with a tendency toward repair occurs in the surrounding tissues.

The incipient pathologic indications are changes in the pericemental membrane, which may lead to the formation of a pericementoma or dental granuloma.

A pericementoma at some stage of its development frequently undergoes central necrosis, due to deficient nutrition, overwhelming activities or the virulence of the microorganisms present and their toxins.

A cavity is thus formed containing pus or necrosed detritus and becomes lined with epithelium, thereby establishing a cyst.

Radicular cysts of the maxilla as a general rule grow faster and attain a much larger size than those of the mandible, due to its cancellous bone structure, although cases have been observed in which mandibular cysts have attained such size as to encroach upon the mandibular canal. When this condition accrues, if the cyst sac is carefully enucleated, the contents of the

canal will remain unimpaired, they generally being found to be outside the cyst sac even though the canal may be destroyed through bone absorption.

When in the proximity of the maxillary sinus they tend to invaginate the contiguous wall of this cavity.

Radicular cyst development is invariably chronic and of slowly progressive nature.

Often no disturbing symptoms arise until the cyst becomes infected or some important structure is pressed upon. This generally occurs when it has attained a considerable size, a large amount of tissue has been destroyed and a number of teeth are involved.

The fluid contents of radicular cysts when not infected is a yellowish straw color, mucilaginous in consistency and contains cholesterin crystals. When infected the contents are more deeply colored, varying from a light amber yellow to a shade of lighter or deeper green, and may be cheesy in substance.

Follicular or dentigerous cysts are very much like those of the radicular type but are rarely infected unless an external communication is created by a progressive pathologic process, or from adjacent structures. Their fluid contents are of a light straw or amber color.

Multiocular cysts, also termed adamantimona or cystic adenoma, are cystic growths of the jaws containing numerous smaller and larger cysts. They are rather uncommon as compared with other cysts of the oral cavity, are observed in young subjects between the ages of twenty and forty, occurring mostly in the mandible and in the female rather than the male.

Mucous cysts are retention cysts, caused by the obstruction of a mucous gland. They may be multiple but are more often single and occur in almost any part of the oral cavity.

The sublingual region, the inner surface of the lower lip, or opposite the premolars and molars are the most frequent sites for their development. The etiologic factor in their formation is usually due to irritation or trauma of the mucous membrane.

Ranula is a retention cyst of the salivary glands in the sublingual region. Any of the salivary glands may be affected. It occurs in both sexes and is not confined to any age. The treatment indicated is in principle and detail the same as that required for other cysts.

The treatment of cysts is always surgical, of which there are several recognized operations. To expedite time, however, I shall mention only one which is personally preferred and done. The patient is first given an antiseptic mouth wash of either Lavoris or Chartex, by the assistant, and requested to thoroughly rinse the mouth, holding the solution in the mouth for a period of several minutes. The field of operation is next swabbed with tincture of iodine and conduction anesthesia is induced in accordance with the operative site in question. After the required period of waiting, the parts are thoroughly tested with a blunt instrument for complete anesthesia. Assuming operative site as extending from first bicuspid to second molar inclusive, in either the maxilla or mandible, the initial step is the partial freeing of the gingival borders buccally and lingually or buccally and palatally to facilitate

application of forceps in the event of necessary extractions and to avoid possible tissue laceration. A small curved periosteal elevator of the Williger type will be found most adequate for this purpose. All teeth shown by the radiographs as included in or approximated by the cystic area should be and are next removed. With a flap knife an incision is made, extending from the occlusobuccal surface of extracted premolar to the occlusodistal and buccal aspect of extracted second molar, and the mucoperiosteum reflected with periosteal elevator and held with tissue retractor by the assistant. A sufficient amount of overlying bone is now removed to fully expose and permit of complete enucleation of the cyst sac. All sharp prominences of bone are next removed with suitable curettes and bone file. The mucoperiosteum is now restored to its former relationship, neatly approximated, dusted with powdered parathesin (Metz) and sutured into position with horse hair. Drainage is secured by light packing of iodoform gauze between the sutures and the entire field of operation is swabbed with tincture of iodine followed by a 25 per cent solution of argyrol. Postoperative treatment consists of renewal of gauze dressing until cavity becomes entirely obliterated. Anacin is prescribed to control postoperative pain. Ice packs externally to minimize swelling and a suitable laxative prescribed to insure proper systemic function. The use of Chartex full strength several times daily will be found most advantageous, due to its marked anodyne and antiseptic properties. All sutures are removed four to five days following operation.

American Society of Oral Surgeons and Exodontists

The tenth Annual Meeting of the American Society of Oral Surgeons and Exodontists will be held at the Radisson Hotel, Minneapolis, Minnesota, August 17 and 18, 1928.

Dr. Harry Bear, Secretary,
410 Professional Building,
Richmond, Va.

ABSTRACT OF CURRENT LITERATURE

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA
DENTAL RADIOGRAPHY

By Dr. Edward Preble, New York City

NUTRITION AND PEDIATRICS

By Dr. Samuel Adams Cohen, New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Orthodontia, Oral Surgery, and Radiography

Exodontia Under Hypnotism. Editorial note in The Dental Surgeon for April 7, 1928, xxv, No. 1222.

The editor states that this subject, while an ancient one, constantly crops out afresh, yet nothing of permanent value has ever resulted. He himself about 1884-5 saw in Nottingham a dentist extract teeth painlessly from a patient who had been placed under hypnosis by one of traveling "professors" who flourished at that period. Members of the press were present. About ten years later he himself extracted several teeth from a woman who had been hypnotized by a qualified medical man. She had remained motionless during the extraction and showed no evidence of pain although some weeks later she recalled the whole experience and stated that while she was unable to move, she had felt everything. Recently, according to the lay press a man in Keighley had offered to demonstrate that the idea was practicable if a patient would come forward for a test and a young woman had at once volunteered but for some outside reason it had not been made. At about the same time a cable from Warsaw announced that a Dr. Radwan had shown the feasibility of the idea by hypnotizing a patient before the Polish Medical Society in order that an extraction could be performed. The success was complete and the patient stated that he had felt nothing. The editor concludes that the idea is practicable but its advisability is another matter.

Sarcoma of the Mandible and Peptone Treatment. Editorial note in The Dental Surgeon, April 7, 1928, xxv, No. 1222.

The editor reproduces a case reported by Dr. C. Wakely before the Royal Society of Medicine. The patient was a boy of seven with a large hard swelling on the right half of the lower jaw and trismus. He was first seen in mid September of last year and after the roentgen ray had shown a probable sarcoma growing from the angle of the jaw a biopsy confirmed the diagnosis while treatment was begun with 200 mg. of radium left in situ for eighteen hours. The tumor did not improve and the patient was now rapidly losing weight but whether this loss came from cachexia or mere

difficulty in feeding is not stated. The case seemed hopeless although nothing is said as to the operability. Colleagues suggested the foreign protein treatment in some form and both goat serum and peptone were used and apparently only by the mouth—10 c.c. of the serum daily and 5 grains of peptone thrice daily. At first the tumor continued to increase in size but was next seen to have come to an arrest while at present it has been receding in size. The boy has taken on weight and has improved in energy. The editor calls the attention of his dental readers to the fact that this kind of case when not far advanced naturally comes to the dentist who should therefore learn all he can about such growths. It is of interest to note that a two-year-old brother of the patient has recently succumbed to a retroperitoneal sarcoma, showing either a family taint, exposure to some common factor or actual transmission.

Resistance of the Teeth of Italians to Caries. G. W. Clapp (New York). Oral Hygiene in Bridgeport. The Dental Digest, May, 1928, xxxiv, 5.

In connection with the work of Dr. Fones of Bridgeport on dental hygiene, the experience with recruits during the war period proved rich in surprises. The troops were made up of Americans, Italians and Europeans from other portions of the continent yet the immunes from caries were almost synonymous with the Italians. No reasons could be discerned for this racial immunity unless yellowness of enamel or crowns with minimal recesses for food lodgment could be assigned. The mouth hygiene of the Italians like that of all other recruits was as bad as could well be and despite the cleanness and hardness of the enamel under favorable conditions there were as many bacterial plaques here as in the other groups. The author is therefore constrained to ask if the diet of the Italians could have been a factor. Most of the recruits had been raised for a time in Italy and those born in this country continued to live in the Italian way. There was indifference to American sweets of all kinds, including candies and iced confections and but little pastry and meat were eaten. The staples were hard bread, fresh fruits and vegetables with an overpowering love for garlic and onions which alone precluded the possibility of a conventionally clean mouth but may have a deterrent action on mouth bacteria. Less than a teaspoonful of sugar daily per capita is the normal ration. The diet of the Americans, which seems to have been adopted largely by the Northern and Central Europeans, differed widely from the above, consisting as is known, of cereals, meats, potatoes, sweets of all kinds and relatively small ration of fruits and vegetables. The enamel in these groups was also mostly of the white or ornamental type and the crowns of the teeth with their high-placed cusps more favorable for the lodgment of food débris.

Spirochetic Disease of the Mouth and Gangrene of the Lung. B. S. Kline and S. Berger, Cleveland. The Journal of the American Dental Association, January, 1928, xv, 1.

The recent claim that gangrene of the lung is due to the action of the Vincent organisms gives this subject some theoretic importance to the den-

tist. The authors believe that in the vast majority of cases mouth spirochetes and fusiform bacilli are responsible. It may be said in passing that according to certain recent bacteriologic developments these two organisms are really different forms of a single basic protozoon and that the so-called bacillus is not a bacillus at all. In any case it is most difficult to visualize that two separate organisms must always be found in association or symbiosis as a cause of disease. The authors who prefer to speak of the Miller-Vincent organisms (just as the Germans speak of the Plaut-Vincent organisms) state that these are readily aspirated into the lungs but often in association with other pathogenics, so that various disease pictures arise. Apparently the pulmonary tissues must first be inflamed before the Vincent organisms can set up gangrene and as a matter of fact it is well known that the latter may supervene in almost any acute or chronic inflammation. Once regarded as a purely surgical affection it is now believed that prompt treatment with arsphenamine is able to control it in the earlier phases. The chief function of the dentist is to keep the mouth free from the organisms and as they tend to accumulate in the interproximal spaces attention must be directed especially to these localities.

Nutrition and Pediatrics

Studies of Calcium Metabolism. P. McIsaac. Brit. Jour. Exper. Biology, March, 1928, v, 3.

In the determination of serum-calcium of pregnant and lactating rabbits, McIsaac found that it is only in the last week or two of pregnancy that the pregnant rabbit shows a variation in calcium serum contents from the controlled nonpregnant rabbit. From seven to ten days before parturition, the serum calcium commences to fall and a day before parturition it declines suddenly to the minimum of the pregnant period.

He quotes Dixon and Marshall who in 1924 stated that there is an ovario-pituitary endocrine mechanism which comes into operation at the close of pregnancy.

The writer continues to state that the excitement of the pituitary at that time not only causes the endocrine to secrete, but also to bring about a very sudden depression in the serum-calcium, perhaps through the pituitary secretion.

The influence of the Internal Secretion of the Ovary on the Calcium Blood Level and on Calcium Metabolism. Louis Mirvish and Louis Pierre Bosman. Quart. Jour. Exper. Med., July, 1927, xviii, Nos. 1 and 2.

In an excellent article in which the authors summarize the recent literature on the ovary and calcium metabolism, these investigators report some of their own findings on experiments on rabbits. They found that the ovary possesses a specific hormone which reduces the concentration of calcium in the blood by 30 per cent. In so far as these results were fairly constant on the male and female rabbit—young and old, pregnant and nonpregnant, as well as in ovariotomized rabbits, they feel that as a result of ovarian injec-

tion (although oral administration with increased doses were just as effective) there is a specific effect of the hormone on the body metabolism.

The maximum fall of 30 to 35 per cent in blood calcium is usually produced in about twenty-four hours and it returns to normal in forty-eight hours.

Studies of Calcium Metabolism. P. McIsaac. Brit. Jour. Biol., March, 1928, v, 3.

In a study of calcium metabolism in relation to sex in the rabbit, McIsaac observes that in the males there is more serum-calcium than in the females, and during pregnancy and lactation the serum-calcium contents of the female fall considerably below that of the males.

The Effect of Ovarian Extract on the Calcium Blood Level in Man. Louis Mirvish and Louis Pierre Bosman. Quart. Jour. Exp. Med., July, 1927, xviii, Nos. 1 and 2.

The authors observed the effects of ovarian extract on calcium blood level after injecting four adult males and four adult females. In seven of these there was a fall of blood calcium by about 35 per cent within twelve to twenty-four hours, usually returning to normal in forty-eight hours. The action of the hormone was the same in both sexes.

Parathyroid Glands as Influenced by Selective Solar Radiations. George M. Higgins and Charles Shear. (Proceedings of the Staff Meeting of the Mayo Clinic, March 7, 1928, iii, 10.)

The authors state that since parathyroid hyperplasia occurs in animals kept upon a calcium-free diet, and since calcium metabolism cannot be carried on without Vitamin D present either in the diet or in the lesser wave length of sunlight, an experiment was tried to determine the effect of selective solar radiations upon parathyroid glands of chicks maintained upon diets in which the calcium content was adequate. As a result of these experiments it was found that the light of certain wave lengths appears to bear a definite relationship to the function of the parathyroid gland. Hyperplasia ensues in the absence of lesser wave lengths of sunlight, but such hyperplasia, Higgins and Shear state, is partially prevented by the addition of a small portion of cod liver oil to the diet.

Stammering Produced by Thyroid Medication. Murray B. Gordon. Am. Jour. Med. Sci., March, 1928, clxxv, 3.

Although the etiology of stammering is still a subject of controversy involving a question of whether the primary disorder is due to peripheral or central disturbance, Gordon feels that one of the exciting factors in the etiology of stammering may be nervous excitation. He states that stammering may be produced by thyroid extract and should be considered as a manifestation of a general nervous excitation following disturbance of the central

nervous system. He reports of five cases of childhood myxedema and hypothyroidism in which stammering occurred during the course of thyroid therapy.

According to Gordon the relationship between the stammering and medication is clearly apparent, so that when stammering occurs during the course of thyroid treatment, it should be treated as other toxic symptoms by an immediate suspension of the medication.

The Effect of Thyroid Therapy on Children. Anne Topper and Philip Cohen. Am. Jour. Dis. Child., February, 1928, xxxv, 2.

In a very well-written article these authorities relate their observations of thyroid therapy on children. In nine children with a normal or high basal rate, thyroid therapy, even as much as 12 to 15 grains daily, did not affect the basal metabolism, nor were there any signs of physiologic reaction to thyroid. Four of these children showed a remarkable increase of growth during the period of observation.

Naturally in children having signs of hypothyroidism, thyroid therapy brought the basal metabolism to normal, and improvement clinically was noted in the children. These children were found to be normal even after thyroid therapy was discontinued.

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EDITORIALS

The American Society of Orthodontists

THE Twenty-seventh Annual Session of the American Society of Orthodontists held at the Hotel Statler, in Buffalo, on Monday, Tuesday, and Wednesday, May 1, 2, and 3, 1928, was one of the most successful meetings held by that Society. Over two hundred and fifty were registered of which two hundred were members of the Society.

The meeting was called to order by President Ellis, who introduced Chancellor Samuel P. Capen of the University of Buffalo, who gave an address on the Past, Present and Future of Dental Education. He stressed the importance and duty of universities in outlining a definite educational policy. He recommended that the fundamental and basic subjects, including Anatomy, Physiology, Chemistry, Histology, etc., be taught to dental students the same

as they are to medical students. We were somewhat surprised to know that Chancellor Capen seemed to believe that this was a revolutionary idea in dental education, when as a matter of fact this policy was followed by some schools more than thirty years ago. There is no question but that dental students should receive the same basis and fundamental instruction as medical students.

President Ellis delivered one of the most practical addresses ever given before the Society. He made several recommendations, the majority of which were later adopted by the Society. The most outstanding was the creation of a Budget Committee the recommendation of which was endorsed by the committee appointed to consider the recommendations of the President. The latter committee consisted of Frank Casto, chairman, and John Mershon and William Fisher.

After the Committee on Recommendations of the President endorsed the recommendations, the following was proposed as a standing resolution: BE IT RESOLVED: That all committees, commissions, boards, and officers present their requests for funds for the ensuing year to the Executive Committee so that the Executive Committee can arrange a budget, said budget to be presented to the Society for approval at a subsequent business meeting.

It is our belief that the transacting of the business of the Society on a budget system is the greatest step made since the organization of the Society. The expenses of the Society are paid from dues received from the members, and it is only fair that the members should have some idea and knowledge of how the various officers expect to spend the Society's money.

Dr. E. Santley Butler, Treasurer-General, presented a financial report of the First International Orthodontic Congress. Later in the meeting William C. Fisher, chairman of the Inter-Relations Committee, outlined the activities that are taking place in regard to the organization of a Second International Orthodontic Congress. The report of the Inter-Relations Committee will be published in this Journal as soon as it can be obtained from the Secretary of the American Society of Orthodontists.

Dr. Albert H. Ketcham, chairman of the Scientific Research Committee, outlined briefly the work that certain members of the orthodontic profession have sponsored at the University of California. This research work has been given editorial mention in previous issues of this Journal. The Scientific Research Committee requested that the Society contribute $4500 for research work to be distributed as follows: $1500 of this amount to reimburse the men in this Society who advanced money to carry on the research work now in progress at the University of California. It is only fair to certain of these men who advanced the $1500 to state that some of them have refused to be reimbursed by the American Society of Orthodontists; they gave the money as a donation. Others seemed to be of the opinion that the money advanced was only a loan which should be repaid to them by the Society at the Twenty-seventh Annual Session. As a result of this difference of opinion and in fairness to the men who expect to receive their money, upon recommendation of the Budget Committee the Society voted that $1500 be repaid to these men.

The remaining $3000 was voted by the Society upon recommendation of the Budget Committee, to carry on the research work at the University of California for the ensuing year. The devoting of this money to research work was made possible by the passing of a resolution at Chicago in 1927, which levied an assessment on the members for three years, 1927, 1928, 1929.

The scientific part of the program was of unusual interest. Dr. Leroy Abbott, Chief of Staff, Shriners' Hospital for Crippled Children of St. Louis, gave an illustrated lecture on the "Technic of the Growth and Lengthening of the Long Bones of Crippled Children." This paper demonstrated a method whereby long bones were lengthened as the result of operation and mechanical manipulations. Dr. Abbott demonstrated the possibility of growth of bones, and his paper should answer some of the criticisms and objections which have been made of orthodontic treatment, especially by those operators who contend that the mandible and maxilla cannot be made to grow by mechanical stimulation. The technic which Dr. Abbott presented can very easily be modified for use in micromandibular development. This lecture should do much in standardizing certain types of orthodontic treatment.

Dr. Clinton C. Howard, Orthodontist of the Good Samaritan (Endocrine) Clinic and the Scottish Rite Hospital for Crippled Children, Atlanta, Georgia, gave a lecture on the "Physiologic Progress of the Bone Centers of the Hands of Normal Children Between the Ages of Five and Sixteen"; also a "Comparative Study of Both Retarded and Accelerated Bone Growth in Children Whose General Skeletal Growth is Similarly Affected." This paper was the result of an enormous amount of work done by Dr. Howard and his associates in studying normal and abnormal children. He showed the possibility of correlation between the development of the teeth and bone centers. Owing to the large number of centers of ossification found in the hand and wrist, Dr. Howard believed that the hand was the most advantageous part of the child to study regarding accelerated and retarded bone growth. The paper was extremely interesting and should eventually bring forth data which would very greatly assist in the progress of orthodontia as a science.

There were two papers devoted to mechanical orthodontia. R. C. Willett, of Peoria, gave a paper on "Cast Overlay Technic and Its Application in Practice." The overlay technic as described by Dr. Willett was considered in the use of cast overlays as molar anchor bands. It was Dr. Willett's contention that the cast overlay was more easily adopted than the average band and was less liable to produce decay and was seldom loosened during the process of treatment.

Dr. Oren A. Oliver, of Nashville, gave a paper on "Complete Technic of the Lingual Arch." This paper was very beautifully prepared and showed step by step, construction of bands, fitting and assembling of the lingual and labial arches with various types of auxiliary springs. This paper, being of a highly technical nature, will be very valuable to all members of the profession when published.

Under the title of "Living Orthodontic Appliances," Dr. Alfred P. Rogers, of Boston, emphasized the importance of maxillary exercise and func-

tion in correcting certain types of malocclusion. Dr. Rogers stressed the statement made by many men that the tooth which assumes position as result of functional activity needs no retention, while one which assumes position as a result of mechanical interference must be retained until functional activity is established.

Case reports were presented by various members of the profession which will be published as part of the Transactions of the American Society of Orthodontists.

The American Society of Orthodontists as organized twenty-seven years ago has grown from less than twelve members to a society with a membership of over two hundred and ninety. Two of the original charter members were present at the Buffalo meeting. Several were present who attended the Second Annual Session. The older men could not help but note the great growth of the Society and the advancement of orthodontia since its organization.

As the result of elections Dr. Oren A. Oliver was made President-elect, Dr. C. R. Baker, Secretary and Treasurer, Dr. Abram Hoffman, Librarian, and Dr. Paul G. Spencer, member of the Board of Censors. The following were nominated for officers and will be voted on: Dr. Harry Kelsey, President-elect; Dr. C. R. Baker, Secretary and Treasurer; Dr. Henry Clay Ferris, Librarian, and Dr. James D. McCoy, member of the Board of Censors.

Dr. J. A. C. Hoggan

1878-1928

IN MEMORIAM

Dr. J. A. C. Hoggan

Dr. J. A. C. Hoggan, who was for ten years dean of the School of Dentistry of the Medical College of Virginia, died in Richmond, Virginia, on March 1, 1928. He was born in Brantford, Ontario, Canada, February 22, 1878. He attended the public schools of his native city and studied dentistry at the Royal College of Dental Surgeons, Toronto, from which institution he graduated in 1900.

Dr. Hoggan was engaged in the general practice of dentistry at Walkerville, Ontario. He later attended the Angle School of Orthodontia at St. Louis, after which he specialized in orthodontia in Hamilton, Ontario. He was much honored by his confreres and was made president of the Ontario Dental Society.

In 1912, Dr. Hoggan moved to Richmond, Virginia, where he confined his practice to orthodontia. He soon built up an enviable practice and won the esteem and admiration of all who knew him. He was professor of orthodontia at the Medical College of Virginia from 1912 to 1927, and dean of the School of Dentistry of the Medical College of Virginia from 1915 to 1925.

Thoroughly devoted to his profession, Dr. Hoggan was a leader among his confreres. He was an able and efficient teacher and left an imprint of his ideals and fine personality upon those who came under his tutorship. He contributed many scientific articles and was a zealous worker for loftier ideals in dental education. At the time of his retirement as dean in 1925 a testimonial banquet was given by the faculty in his honor. Expressions of gratitude and appreciation for his labors were evidenced on this occasion.

He was a former president of the Richmond Dental Society, a Fellow of the American College of Dentists, and a member of the Psi Omega and Omricon Kappa Upsilon fraternities. He was also a member of numerous social and civic clubs.

Besides his professional duties, Dr. Hoggan found much relaxation in painting and sculpture. He was no mean artist in this direction and his works were greatly admired. He was a kind and benevolent individual and a very charitable person, having contributed largely to many causes.

His private life was filled with an expression of beauty, for he was a devoted husband and father. His sudden death on March 1, 1928, was a shock to his host of friends and admirers. He is survived by his wife and son, Jack Large Cameron, now a student at the University of Virginia.

Dr. Charles F. Bowles,
Richmond, Va.

ORTHODONTIC NEWS AND NOTES

Southwestern Society of Orthodontists

Report of the Eighth Annual Meeting, April 26-28, 1928

Twenty clinics were presented and papers by Dr. Frank Neff, Kansas City; Dr. A. H. Ketcham, Denver; Dr. Karl Menninger, Topeka. On account of sickness, Dr. C. O. Simpson of St. Louis was unable to be present. Papers presented will appear in early issues of this journal.

The attendance exceeded fifty in number, and the following new members were voted into the Society: Dr. Richard Gribble, Dodge City; Dr. W. J. Key, Hutchinson; Dr. P. G. Ludwick, Lincoln; Dr. R. E. Olsen, Wichita; Dr. E. E. Richardson, San Francisco.

The society voted not to hold a joint meeting with the Southern Society in 1929.

The time and place of the 1929 session will be selected by the officers and board of censors during the months of either January or February, with Dallas as the probable meeting place.

The golf event was pulled off by the Kansas City boys without a hitch. Dr. H. B. Robison won the championship cup which was presented by The C. V. Mosby Company, St. Louis. Everyone playing was able to win a prize, and through the kindness of Dr. Bennett Hill, Salem, Oregon, all the members were included in the movie film. Have your local theatre secure it, or watch the "Police Gazette."

The incoming officers are Dr. E. B. Arnold, Houston, President; Dr. H. B. Robison, Great Bend, President-Elect; Dr. P. G. Spencer, Waco, Texas, Secretary-Treasurer; Dr. Louis Winston, Houston, Three-Year-Member Board of Censors.

Dr. Paul G. Spencer, Secretary.

Notes of Interest

Dr. E. Percy Hollingshead, formerly with Dr. J. L. Young and Dr. F. C. Kemple, announces the opening of his office in The Professional Building, S. E. Cor. 54th Street and Fifth Avenue, New York City. Practice limited to orthodontia.

Dr. Mort Henkin announces the removal of his offices to Suite 479-80 New Orpheum Building, Sixth and Pierce Streets, Sioux City, Iowa. Practice limited to orthodontia.

Dr. Clayton A. Sayers announces the removal of his office to 1601 State Tower Building, Syracuse, N. Y. Practice limited to orthodontia.

Dr. Wm. Bert Stevenson announces the removal of his offices to the Fisk Medical and Professional Building, Amarillo, Texas. Practice limited to orthodontia.

Dr. Kirman E. Taylor announces the opening of his office for the exclusive practice of orthodontia at 502 Mack Building, Denver, Colo.

Dr. Carl N. Dorman announces the removal of his offices to Medico-Dental Building, Eleventh and L Streets, Sacramento, Calif. Practice limited to orthodontia.